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TO ADVERTISERS

CHANGES for advertisements should be in this office by Friday noon for the following week's issue.
NEW ADVERTISEMENTS should be in the office not later than Monday noon to insure publication in that week's issue.

In these hot days we owe so much to the electric fan that we hardly realize it ourselves. If anybody wishes to know the amount of his indebtedness to the fan, just let him shut off the current on one of these torrid, humid July days and feel his temperature rise to the incandescing point.

With this issue is begun the thirty-ninth volume of the ELECTRICAL REVIEW, which will close the twentieth year of its existence. To all of the many friends and contributors who have played so large a part in the success of former volumes the ELECTRICAL REVIEW here returns its thanks, promising, at the same time, to spare no endeavor to make each succeeding volume more interesting and instructive than its predecessor.

THE PRIZE WINNING ARTICLE.

In the ELECTRICAL REVIEW for February 23, 1901, an offer of a prize of one hundred dollars for the best article upon the electric lighting central station superintendent was made.

It was desired to obtain a practical and valuable essay upon the central station superintendent and his duties; one describing how best a candidate for such a position might fit himself to insure success in it, and one describing the type of man most likely to succeed in that direction of endeavor. In order to secure the best opinion upon the matter from men having large experience in the electrical lighting industry, we requested Mr. C. L. Edgar, president of the Edison Electric Illuminating Company of Boston; Mr. Charles R. Huntley, general manager of the Buffalo General Electric Company, of Buffalo, N. Y., and Mr. Alden M. Young, vice-president of the Kings County Electric Light and Power Company, of Brooklyn, N. Y., to act as a committee and award the prize to the best manuscript submitted. The thanks of the ELECTRICAL REVIEW are due to these gentlemen who have very conscientiously read the various manuscripts (submitted to them with the names of the authors omitted) and rendered their decision. It is desired to take this opportunity to express our gratitude for the trouble they have so willingly undertaken.

The prize is awarded to Mr. James H. Vail, of Philadelphia, and the article will appear in the next number (July 13) of the ELECTRICAL REVIEW. Mr. Vail's paper very fully meets all the specifications of the original offer and is one that is worthy not only of the perusal of every man interested in electric lighting, but also of preservation both as a guide to those who desire to succeed in the profession of station management and as a description of an ideal to which those now in the profession should endeavor to attain. In conclusion, the ELECTRICAL REVIEW desires to state that of the other papers received in this competition two were especially meritorious and deserve most honorable mention. These were written by Mr. George T. Hanchett, of New York, and Mr. G. Wilbur Hubley, of Louisville, Ky.

ELECTRICAL EDUCATION.

Through the summer time plans are generally made for entering students at various schools and for beginning the business careers of those who have graduated in the earlier months from institutions of learning. The subject of electrical education is one of the utmost importance to the future of the art and to the welfare of those who enter the profession in any capacity. It is therefore well to call attention to certain phases of it very generally overlooked and to which, from their importance, it is hardly possible to give undue care.

The teachings of the scientific or technical schools absolutely must be supplemented by practical, hard-work experience in the direction which is chosen by the student to be his career. A young man, coming out of one of our best schools with the title of electrical engineer, is not really fitted to practice that profession until he has spent a year or two in seeing actual practice from the inside — that is, by actually doing practical work with his own hands, and applying to conditions as they really exist the knowledge that he gained in the institution of learning. To the young man who has just graduated a certainty of this fact comes sooner or later, and unless he is prepared beforehand with an understanding of the conditions that he must face he is placed in a position of no little difficulty when he starts out looking for a situation. It should, therefore, be recognized that a year's work (often at exceedingly small wages) is really necessary to fit the technical graduate for entrance upon the career which he has chosen.

A mistake which is all too frequently

made by young men in technical schools, and by their parents, is to neglect other branches of study while pursuing that relating directly to their profession. A good, working knowledge of at least one other language besides English is of the most extreme value to an electrical man and amply repays the trouble taken in acquiring it. To-day, perhaps, German is the most valuable, but if the student can master a good reading knowledge of French as well, he is fitted to take in all of the best of electrical literature from first hands and also, in many other ways, better prepared to play his part in his chosen field of activity.

A good and thorough training in mathematics is practically essential to an electrical engineer. There is rather a tendency in the schools to make courses of instruction easy and to minimize the amount of mathematical knowledge required of students. This can not well be regarded as anything but a mistake. While it is not likely that the average practicing engineer or shop superintendent or designer will use the calculus much in his professional work, still the mental training he requires in learning it, the amazing insight it gives him into all other kinds of mathematical processes, and the fact that many of the discoveries in electrical theory can not be understood without a fair working knowledge of this branch of analysis, all combine to make it a practical essential.

As a general rule it may safely be laid down that a good education is the foundation upon which a technical course of instruction should be laid. A man who knows a great deal about electricity and nothing about anything else is not nearly so valuable or so likely to succeed as a man who knows half as much about electricity and has in addition a good general education and the degree of culture that goes with it.

In the United States we need at present two kinds of electrical men—skilled and thoroughly trained artisans, and men of high scientific attainments combined with wide general culture. From the first class we may expect practical work of the utmost value, and from the second we may look for discovery and invention, research and calculation that will form the basis for the labors of ensuing generations of artisans. For the half-educated electrical engineer there is practically no place at all.

ON TELEPHONE CLERKS.

In many industrial establishments the art of answering the telephone has been thoroughly learned, but in others it is regrettable to state that this simple matter seems to have escaped attention, and the telephone is put in the hands of an ignorant and often impolite person. No business house would consider for a moment putting at its office entrance any person to receive visitors and answer their questions who was not familiar with the work of the establishment, and who was not polite and willing to extend every possible courtesy to visitors and inquirers. Yet the telephone, which is rapidly coming to be the most important door to the business office, is all too frequently put into the hands of incompetent, impolite and ignorant persons. The matter is one of really great importance. As it progresses and the use of the telephone becomes more general, more and more of the world's business is being done over it, and it is becoming constantly more important that the person answering telephone calls should be competent to give correct and intelligent answers and give them politely. No one who is familiar with the general indifference of office boys and such, as experienced over the telephone, will wonder at these remarks. Here is a place for a thorough and far-reaching reform.

In a recent Sunday edition, our esteemed contemporary, the New York *Herald,* in treating of the evolution of Herald Square in the future, prints a beautiful, full page picture of that region of the metropolis as it will appear in the dim future when high buildings shut in the squat structure of our contemporary on all sides. Immediately in the middle of the near foreground is an elevated train drawn by a steam locomotive! It is perfectly evident that the artist of the *Herald* (and the editor who supervises its pictorial efforts), do not believe that the future will see electric traction on the elevated railways; but in this particular they are certainly grievously mistaken. The anachronism is as perfect as if the artist had shown horse cars in the section of Broadway exhibited.

ELECTROCHEMISTRY.

In early forthcoming numbers of the ELECTRICAL REVIEW will be presented a series of papers under the general title of "Selected Chapters in Electrochemistry," by Professor Harry C. Jones, of the Johns Hopkins University. These papers will cover the theory of electrolytic dissociation, the new theories of electrolysis, the questions of velocity of ions and conductivity of solutions, and will exhibit the applications of current knowledge of osmotic pressure and the solution tension of metals to the calculation of the electro-motive force of primary cells, etc. The authority that attaches to the author of these papers, and the extraordinary importance of the subjects that they embrace, will lend additional interest to a series that promises to be one of the most important that has been published of late years in the technical press.

THE NORTHWESTERN CONVENTION.

The Northwestern Electrical Association has just had another of its successful summer conventions, at Sheboygan, Wis., of which a complete report will be found on other pages. The account of practical work in the line of training apprentices, given before the association by Professor B. V. Swenson, of the University of Wisconsin, is highly interesting and instructive. An abstract of it appears on another page of this issue, and it is commended to the careful attention of the authorities of other institutions of learning who have the facilities to give laboratory training.

The association did what it met to do—read and discussed papers and had a good time. The Northwestern Association always has a good time and this year's meeting was no exception to that happy rule.

What a twofold blessing the trolley car has proven to be for the inhabitants—human and beasts of burden—of our cities. In the hot summer evenings in New York the open cars are filled until late at night with crowds of people, often family parties, who ride the length of the lines for the benefit of the grateful breeze stirred up by the car's motion. And there are no sweating and straining horses to suffer for their pleasure. Truly the trolley car is the chariot of civilization.

THE THEORY OF ALTERNATING DYNAMO ELECTRIC MECHANISMS—XXXIII.

BY W. ELWELL GOLDSBOROUGH.

POLYPHASE CIRCUITS.

In alternate current working it is frequently desirable to impress one or more independent but synchronous electro-motive forces upon the same distributing system. Methods involving this practice are, in fact, very generally applied

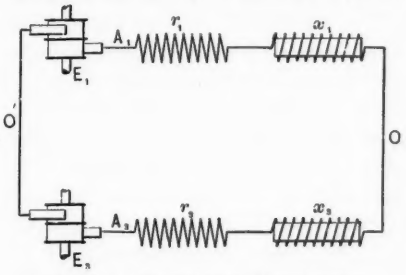


FIG. 88.—ALTERNATING MECHANISMS.

where *power* is distributed by means of alternating currents In general, systems which are influenced by but one impressed electro-motive force are only employed where power is distributed for arc and incandescent lighting uses alone.

In view of the fact that the phenomena which appertain to polyphase or multi-electro-motive-force circuits are somewhat more complex in nature than those which attend the operation of single phase or single electro-motive-force circuits, an effort will be made to develop the subject matter in such manner as to enable the reader to readily grasp the fundamental principles underlying these phenomena. To this end we will first consider a system such as that shown in Fig. 88. Here we have the two alternators, E^{I} and E^{III}, impressed upon the system A_1OA_3. The two alternators operate in synchronism; that is, they develop currents of the same frequency, but their electro-motive forces are not, necessarily, in phase. It remains to be shown how the system is to be treated to make a correct determination of the current which is set up through the receivers when both electro-motive forces are acting.

In following through the method we will suppose the resistance and reactance of the alternator armatures to be negligible quantities. We have, then, only to deal with the line resistances r_1 and r_3 and the line inductances L_1 and L_3. Consider that, initially, the armature of E^{III} is developing no electro-motive force; E^{I} will then be the only electro-motive force acting. It will accordingly set up in the system a current, the value of which can be determined by the method employed on page 244, where the action of an electro-motive force impressed upon a system of series circuits is discussed. Accordingly, in that part of Fig. 89 embraced by the triangle $OA^{I}C^{I}$, we have the phase diagram resulting from the action of E^{I}. For applying equation 54,

$$I^{I} = \frac{E^{I}}{\sqrt{(r_1 + r_3)^2 + (x_1 + x_3)^2}}$$

and, with I^{I} determined, the diagram is readily constructed, since $OC_3^{I} = I^{I} r_3$, $C_3^{I}A_3^{I} = I^{I} x_3$, $A_3^{I}C_1^{I} = I^{I} r_1$ and $C_1^{I}A^{I} = I^{I} x_1$. Therefore the electro-motive force $OA^{I} = E^{I}$ appears in the system having two components OA_3^{I} and $A_3^{I}A^{I}$, the former being the potential between the points A_3O of Fig. 88, and the latter the potential between OA_1.

In this diagram the current I^{I} is shown by the vector OB^{I}. Suppose now that the electro-motive force developed by the first alternator is reduced to zero, and that the electro-motive force of the other alternator is brought up to E^{III}, designated by the vector OA^{III} of Fig. 89 in value and phase position relatively to the initial value of $E^{I} = OA^{I}$.

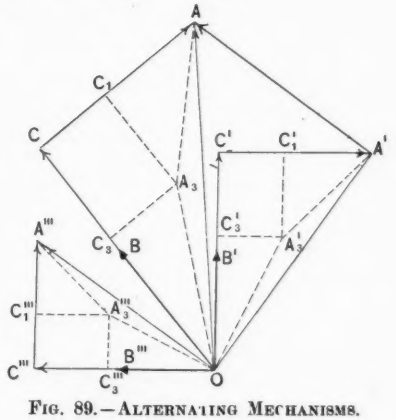


FIG. 89.—ALTERNATING MECHANISMS.

By a similar application of equation 54 we can now construct the phase diagram $OA^{III}C^{III}$. In this case OA_3^{III} and $A_3^{III}A^{III}$ are the two line components which equal the impressed electro-motive force E^{III}. The current which will flow in the system will now have a value of $I^{III} = OB^{III}$. We see, therefore, the exact conditions which prevail when either of the two electro-motive forces are acting independently. When they are acting simultaneously the same phase relations can be said to still exist. However, the general result which obtains is better represented by taking the resultants of the corresponding vectors of the two diagrams. If we follow out this suggestion the resultant of OA^{I} and OA^{III} becomes the vector OA. The resultant of the vectors OC^{I} and OC^{III} becomes the vector OC. The resultant of the vectors $C^{I}A^{I}$ and $C^{III}A^{III}$ becomes the vector CA and the resultant of the vectors OB^{I} and OB^{III} becomes the vector OB.

The phase diagram, therefore, which is represented by OAB, shows the combined effect of the two electro-motive forces acting synchronously. In this diagram since OA_3 is the resultant of OA_3^{I} and OA_3^{III}, it is the final electro-motive force which appears at the terminals of the circuit A_3O of Fig. 88. Correspondingly, A_3A is the electro-motive force appearing between the points OA_1 of Fig. 88.

In following this discussion through, the fact is brought prominently before the mind, that a graphical solution can be very readily applied to the treatment of a system in which one or more electro-motive forces act. If, as shown in the skeleton diagram of Fig. 90, the electro-motive force E^{III} is given different phase positions relatively to the electro-motive force E^{I}, the resultant effective electro-motive force active in the system will follow the locus $AA^{b}A^{c}$, and the resultant current correspondingly follow the locus $BB^{b}B^{c}$; and, as the electro-motive forces E^{I} and E^{III} come more and more nearly in phase, the line current will increase.

In Fig. 91 sinusoidal curves are displayed to show the relative phase positions occupied by the electro-motive force vectors and currents which appear in Fig. 90. These can be readily associated with the vectors by which they are developed, in view of like letter designations. For instance, the vector OA develops the electro-motive force curve A, and the vector OB the current curve B, etc.

Example 19.

Given: Two alternating current generators operated synchronously. One of them develops an electro-motive force

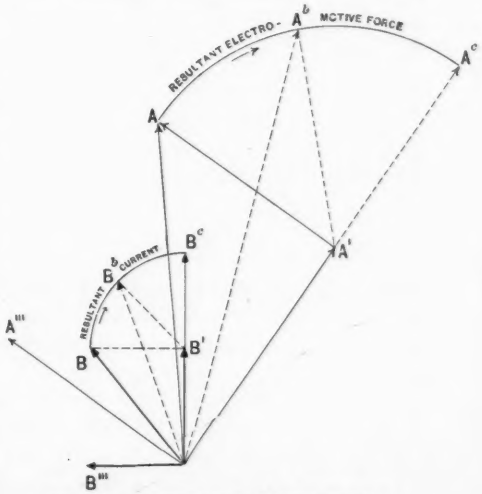


FIG. 90.—ALTERNATING MECHANISMS.

of 1,200 volts, the second an electro-motive force of 1,000 volts. Further, the relative phase displacement of their armatures is such that the phase difference between their electro-motive forces amounts to 90°. The machines are connected in series and impressed upon a system con-

sisting of two circuits. The first circuit has a resistance of 15 ohms and a reactance of 15 ohms also. The second has a resistance of 22.4 ohms, and a reactance of 11.2 ohms. What will be the value of the line current set up in the system by the two generators?

In the solution of the problem, we will briefly follow through the calculations by applying the method just outlined. Consider the generator which develops 1,200 volts to be acting alone. Applying equation 54,

$$I^I = \frac{1{,}200}{\sqrt{(15+22.4)^2+(15+11.2)^2}} =$$

26.3 amperes,

we find that a current of 26.3 amperes will be set up in the circuit. The resistance drop in the first circuit A_1O will be

$$A_3^I C_1^I = I^I r_1 = 26.3 \times 15 = 349 \text{ volts.}$$

The reactance drop in the first circuit will be

$$C_1^I A^I = I^I x_1 = 26.3 \times 15 = 394 \text{ volts.}$$

Consequently the difference of pressure at the terminals of the first circuit will be 556 volts. Similarly, the resistance drop in the second circuit OA_3 will be 589 volts, the reactance drop 294 volts, and the electro-motive force apparent at the terminals of the second circuit 658 volts.

Laying off the vector diagram showing the relative values and phase positions of these vectors, we get the figure OA^IC^I, in which

$OA_3^I = 658$ volts.

$A_3^I A^I = 556$ volts.

$OA^I = 1{,}200$ volts.

If the second generator is assumed to be acting alone on the system, we will have the system influenced by 1,000 volts instead of 1,200 volts; consequently the phase diagram illustrative of the conditions existing in the second case will be similar to the diagram just developed, but smaller, in the ratio of 1,200 to 1,000.

When the diagram representative of the action of the second machine is associated with the diagram due to the first machine, the angular displacement between the generator electro-motive forces must be made 90°, consequently, relatively to the first, the second phase diagram assumes the position $OA^{III}C^{III}$. Now, when the first alternator is running, the line current has a value of $OB^I = 26.3$ amperes, as already determined; and when the second machine is acting, the line current will have a value of $OB = 21.9$ amperes, a value determinable by applying equation 54. Consequently when both machines are acting together, there will be impressed upon the system an electro-motive that will set up a current equal to the resultant of the two current vectors; therefore, we find the line current has a value of $OB = 34.2$ amperes.

In this solution we have applied the general principle that, if the current due to each electro-motive force acting separately is found, the current which flows when both electro-motive forces are acting together is the vector sum of the partial currents.

Science Brevities

Picture Telegraphy—Many attempts, more or less successful, have been made to transmit pictures through a telegraph line, says the London *Electrical Review*. Elisha Gray and others have used the writing telegraph to make facsimile drawings at a distance, and Szczepanik has devised an apparatus intended to enable us to actually see by telegraph, but this apparatus is complicated, and has not as yet been practically successful. Quite recently Herr Otto von Bronk has devised a simple and ingenious apparatus for printing at the receiver a photograph of any illuminated object placed in front of a lens at the transmitter. Herr von Bronk makes use of the wonderful susceptibility of steel wires to magnetic strain, utilized by Poulsen in his telegraphone. The image or the object is thrown by a photographic lens on a surface made up of a mosaic of selenium cells. Each cell is in circuit with one of a series of electromagnets arranged so as to produce transverse magnetic strains in a ring of steel wire, each strain being, of course, proportional to the intensity of light acting on its corresponding selenium cell. These strains are reproduced on a similar ring at the receiving station by a synchronous rotating arm, just as a telegraphone record would be copied on to another wire moving at the same speed. By reversing the original operation, the magnetic copy of the picture is retranslated into an optical one, a photographic negative being produced. The apparatus is described in detail in the *Elektrotechnische Mittheilungen*.

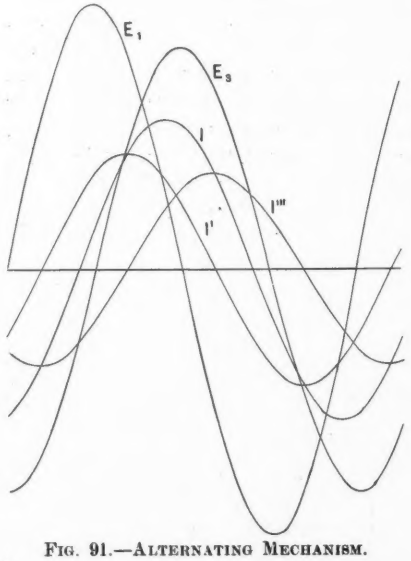


FIG. 91.—ALTERNATING MECHANISM.

Electromagnetic Properties of the Ether—As an attempt to clear up the obscurities attached to Maxwell's theory concerning electrostatic phenomena, Herr L. Graetz has formulated a theory which he claims to be free from contradictions, either in itself or with experiments. The *Electrician* abstracts his conclusions as follows: He assumes the ether to be an elastic solid, and therefore attributes to it the same properties as Fresnel and Neumann did. In ponderable matter the ether experiences an influence which is manifested as a force as soon as there is a displacement in the ether. The force exerted by the molecule upon the ether is manifested in a local change of the density of the ether, while the ether retaliates by displacing the molecule from its normal position. Those parts of a material body in which such a displacement exists permanently are the ions. This action and reaction between the ether and the molecules leads to Maxwell's equations. The so-called magnetic polarizations, or displacements, are determined by the torsion of the ether elements, while the electric forces, all except some electrostatic ones, are the velocities of the ether particles. The magnetic energy of a body is the potential energy of the ether contained in it. The electric energy consists of two parts, one of which is the kinetic energy of the ether, whereas the other is the potential energy of ponderable matter. "True" magnetism, assumed to be zero in Maxwell's theory, has no meaning whatever. The magnetic properties of iron may be brought in as special molecular torsions. The so-called true electricity consists of the amount of ether contained by a given volume in excess or defect of the normal amount. A current consists in the transformation of rectilinear motions of molecules into heat vibrations. The conception that the ether surrounding every molecule is attached to it, implies that a totally independent relative motion of ether and matter is impossible.

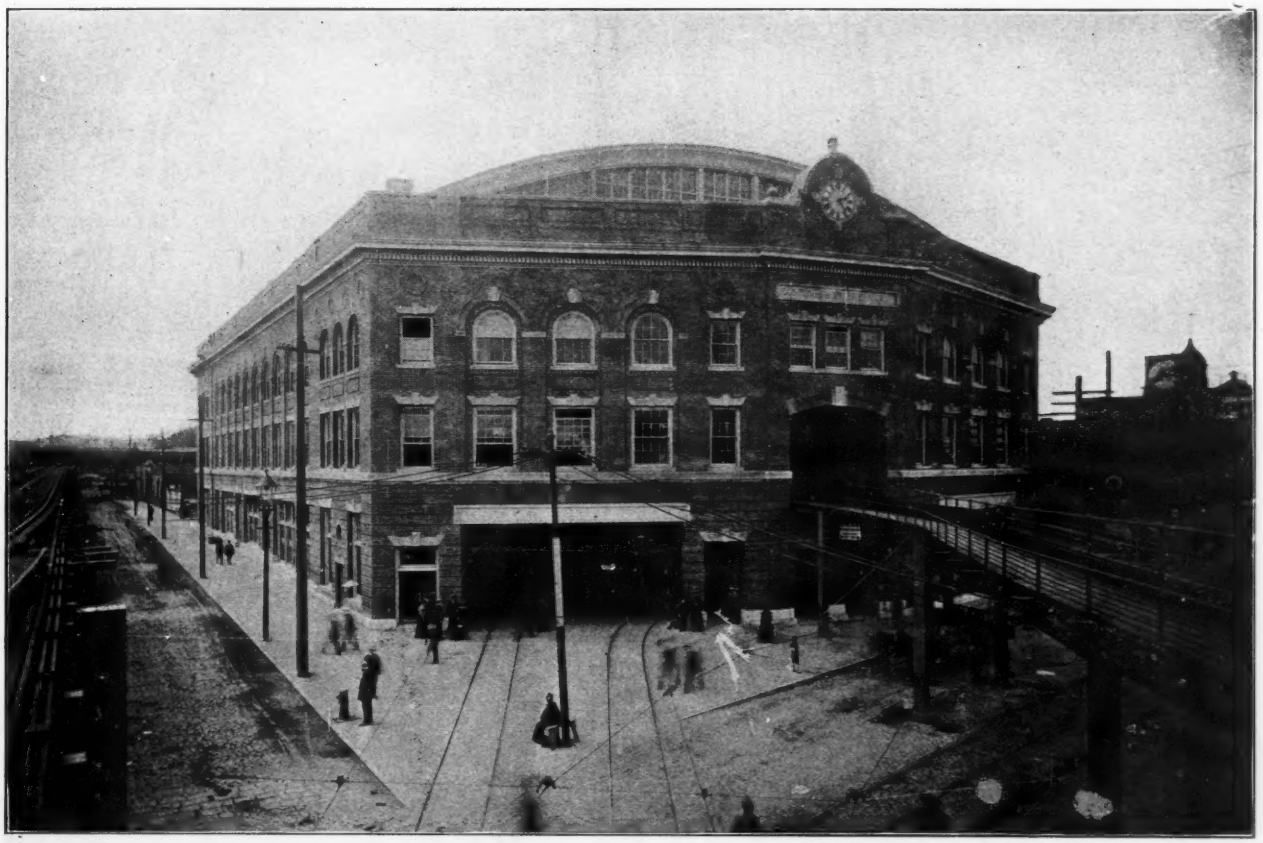
In 1900 the production of carborundum was 1,300 tons as against 807 tons the year before.

The Boston Electric Elevated Railway—II.

Some Notes on the Equipment of the Boston Elevated Railway Company's New Lines, Power Stations and Trains.

(Concluded.)

IN ADDITION to the Lincoln power-house, described in the first installment of this article, the Boston Elevated Railway Company possesses a number of others, some of which will be used in connection with the development of the elevated railway system when this reaches its full extension. The fine power station of 6,000-horse-power capacity, situated near Harvard Square, in Cambridge, will supply power to at least a portion of the east and west section of the elevated railway, and one of the illustrations shows the boiler room, in which Babcock & Wilcox boilers are used.



EXTERIOR OF THE SULLIVAN SQUARE TERMINUS OF THE BOSTON ELEVATED RAILWAY.

As in the Lincoln station, the matter of coal handling is reduced here practically to a question of maintaining automatic machinery. The coal is sent up to an overhead track above the floor in front of the boilers by cars driven by a cable up an inclined plane. These cars are brought to the front of the boilers and there dumped, their contents running down steel inclines to the hoppers of the Acme stokers with which the boilers are provided. These stokers merit a passing word for their great ingenuity of construction. Coal descends by its own weight through the hopper and is automatically forced, by a positive motion of a reciprocating plunger, upon the top of a short grate made in the form of a quadrant and surmounted by an arch of fire bricks. Here the coal gives up its gaseous elements, which are fully burned in the intense heat under the brick arch and, gradually coking as it goes, descends until it reaches the top of an inclined grate composed of separate bars. While these bars are set very close together their peculiar design is such that more than 50 per cent of the grate surface is air space. Alternate bars are connected, at their lower ends, together upon a frame which is rocked by the mechanism driving the stoker, so that these bars ascend at intervals through the others, slicing and breaking up the mass of coal as it descends. At the bottom of the incline is a dumping grate which may be lowered entirely out of the way in case it is necessary to pass a large clinker. The operation of this device is entirely automatic. The feed of coal can be set by turning a hand-wheel regulating the stroke of the feeding plunger, while the slicing action of the inclined grate bars may also be set in the same way, so that any desired degree of openness of fire may be maintained, from a dull, smouldering banked fire to a clear, bright blaze, consuming 45 pounds of coal per square feet of grate surface in an hour without smoke.

Another interesting feature of the stokers is that the inclined grate may instantly be lowered to a level position, permitting hand firing in the usual way, should any accident overtake the driving mechanism or the overhead coal-supply. Such cases have happened in the history of the stations and in one instance, the time being a severe period of the winter, the Harvard Square station was able to go on by hand firing without falling below its normal pressure of steam, while repairs lasting nearly 24 hours were being made to the overhead coal-supply mechanism. In the Lincoln power-house these stokers are

driven by small steam engines direct-coupled to the driving shafts. In the Harvard Square station they are driven by belts from an overhead shaft operated by an electric motor.

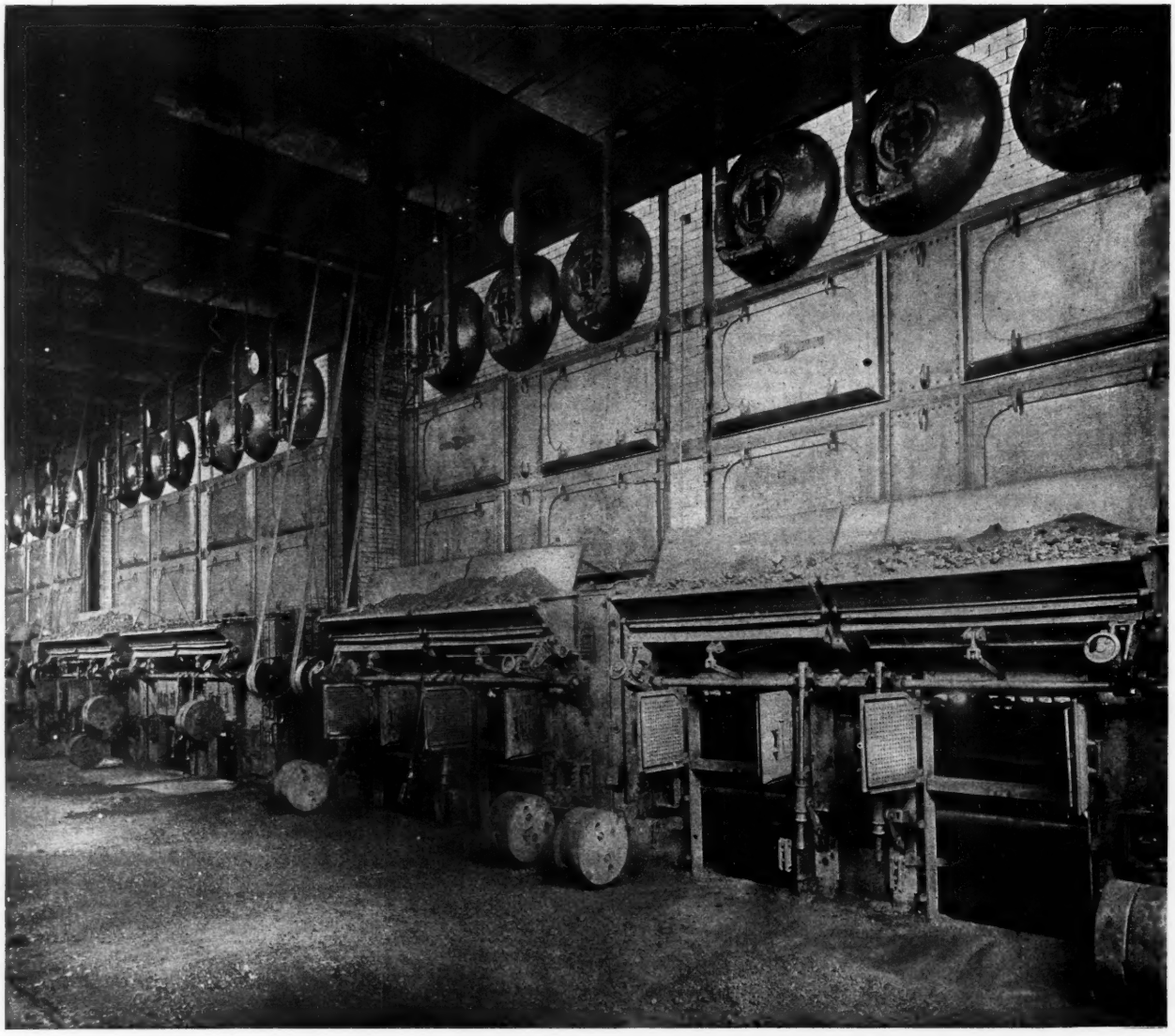
THE ELEVATED STRUCTURE.

With the exception of the section near the Dudley street station at the southern extremity of the lines and the Charlestown bridge section crossing the Charles River, which were built respectively by the Pennsylvania Steel Company and the Carnegie Steel Company, the entire steel structure was made by the Pencoyd Iron Works. The accompanying illustrations show two typical cross-sections of the double-track structure and a longitudinal elevation. Variations in height of the elevated structure are nowhere so marked as they are in New York city, the tracks maintaining a practically even elevation above the street and following somewhat closely the configuration of the surface. On account of the intricate plan of Boston the longest straight section or tangent upon the system is only 600 feet, the line being mostly curves, as may easily be gathered from inspecting the map printed in connection with the first part of this article. The two typical cross-sections exhibit structures used in different places either on account of differing widths of street or other local considerations. In one of them each track is supported immediately above the supporting columns, while in the other the track is carried on girders thrown across from side to side of the street. In all cases head room is left below the structure sufficient for the existing surface trolley lines which are operated by the same company.

In another illustration is shown a cross-section of the track deck, showing the arrangement of the cross ties, running rails and conductor rails, as well as the wooden guard rails and feeding conductors.

Both the track rails and the conductor or "third" rails are of steel of 85 pounds to the yard weight and of the regular standard T section. At each joint of the conductor rail two copper bonds, each of 450,000 circular mils, cross-sectioned are used, these bonds being seven inches long. On the track rails each joint is connected with two 350,000 circular mil bonds, each 12 inches long.

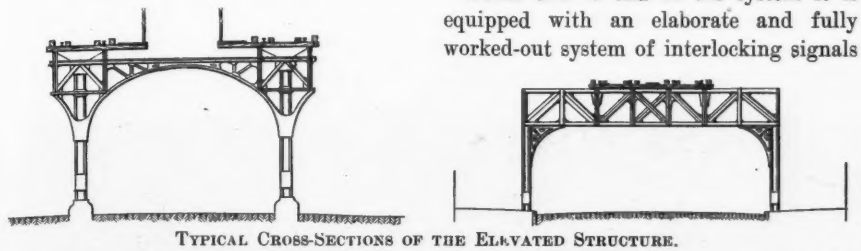
The feeder cables are of tinned copper, stranded, of from 750,000 to 1,000,000 circular mils area and are laid without tie-wires upon the tops of heavy glass insulators, well shown in one of the illustrations. These insulators are mounted between the conductor rails, which are in turn inside of the running tracks, and the feeding system is boxed in with wooden boards, the top being made in sections



BOILER FRONTS IN THE HARVARD SQUARE STATION, SHOWING AUTOMATIC STOKERS.

several feet long which may be lifted off to render inspection of the lines easy. The top of this boxing forms a walk-way between the two tracks.

The conductor is mounted upon insulators, made by Messrs. Albert & J. M. Anderson, of Boston, consisting of two bronze castings, one of which is bolted to the cross-tie and the other arranged with clutches to hold the flange of the third-rail. The two are separated by a bell of hard fibre which is further protected by a bell-shaped extension of the upper section.

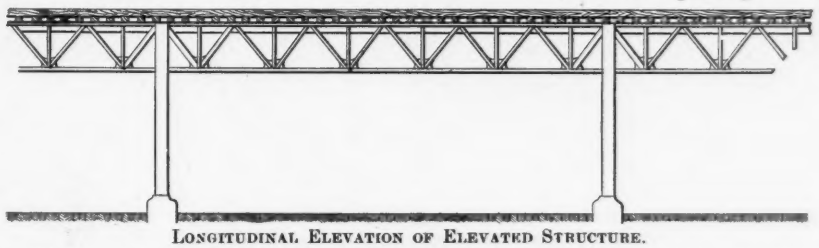


TYPICAL CROSS-SECTIONS OF THE ELEVATED STRUCTURE.

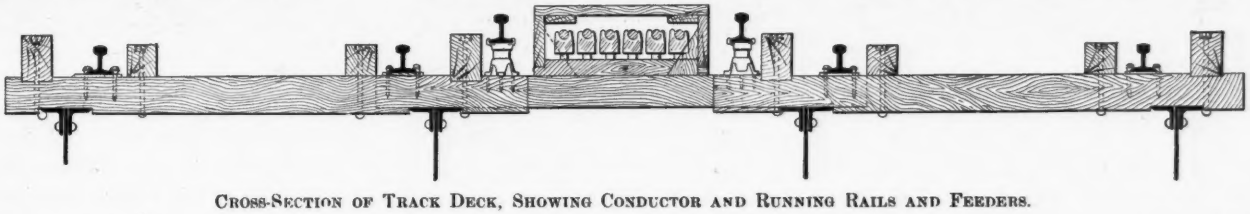
The large majority of the line stations are located between the two tracks and have platforms at one end only. These station houses are built of sheet copper, left to take its natural *patina* in the weather and are exceedingly graceful structures, satisfying to the artistic eye. Passengers are admitted to them, upon payment of fare, through a registering turnstile and each station is provided with a waiting room, ticket office and all the usual conveniences. The interior finish and decoration of these stations are very handsome, though at the same time marked with the plainness that characterizes the best taste. The wood work of the interiors is in hard woods in natural finish, highly polished and calculated easily to be kept perfectly clean. The stations are all lighted electrically and in winter are heated by coal furnaces. The platforms are long enough to accommodate five-car trains and are adequately housed and covered in from the weather.

From terminal to terminal, around the Atlantic avenue side of the loop in the heart of the city of Boston proper, the total length of the elevated structure is a little more than five miles; measuring through the subway it is a little less. In the operation of the system it is intended that part of the trains shall run through always on the elevated structure *via* Atlantic avenue, and part of them through the subway; but it is not unlikely that loop trains will be put on to run around the loop including the subway and Atlantic avenue structure in both directions.

From end to end of the system it is equipped with an elaborate and fully worked-out system of interlocking signals for the protection of trains. The details of the arrangement and installation of this system, which is of the electro-pneumatic type, were largely due to Mr. S. S. Neff, superintendent of the Boston elevated lines, the apparatus having been built by the Union Switch and Signal Company, of Swissvale, Pa. The tracks have been divided into 85 blocks, each corresponding with one minute's run under the normal running time of trains. At each there is an automatic tripping device that instantly sets the air-brakes on any trains attempting to run past the danger signal. The headway of trains is thus absolutely limited to one minute, but, as described below, this difficulty is somewhat palliated by the flexibility of the control system used, while at the same time it entirely safeguards the passengers from danger of collision. Eight switching towers altogether are in use, the machinery in five of them being operated by compressed air. One of these towers contains 35 levers.



LONGITUDINAL ELEVATION OF ELEVATED STRUCTURE.



CROSS-SECTION OF TRACK DECK, SHOWING CONDUCTOR AND RUNNING RAILS AND FEEDERS.

OPERATION.

As was explained in the first part of this paper, the conditions in Boston are such that its traffic is best handled from centres of distribution in its northern, southern, eastern and western suburbs, connected by means of high-speed lines running through the heart of the city. The present section of the elevated railway running north and south, has terminals of this character at Dudley street, in Roxbury, to the south, and Sullivan Square, in Charlestown, to the north. It is believed that they are the most elaborate termini that have ever been constructed for street railway or intra-urban railway service.

Two of the accompanying illustrations represent the exterior and interior of the Sullivan Square station. This station is built over one side of the loop on the elevated tracks, the elevated trains stopping under a train arch well shown in the interior view. Here the passengers alight upon flush platforms, and upon the same level of the station are 10 dead-end tracks for connecting trolley cars radiating upon different lines to the north, east and west of the station. It will be noted that there are no stairs to climb, and no opportunity for confusion, as surface cars of each particular route always stop upon the same dead-end track which passengers soon learn to recognize; the whole method is the simplest and most satisfactory that could be devised. During the crowded hours of morning and evening the traffic is all one way, so there is no meeting of opposing currents of humanity in the station.

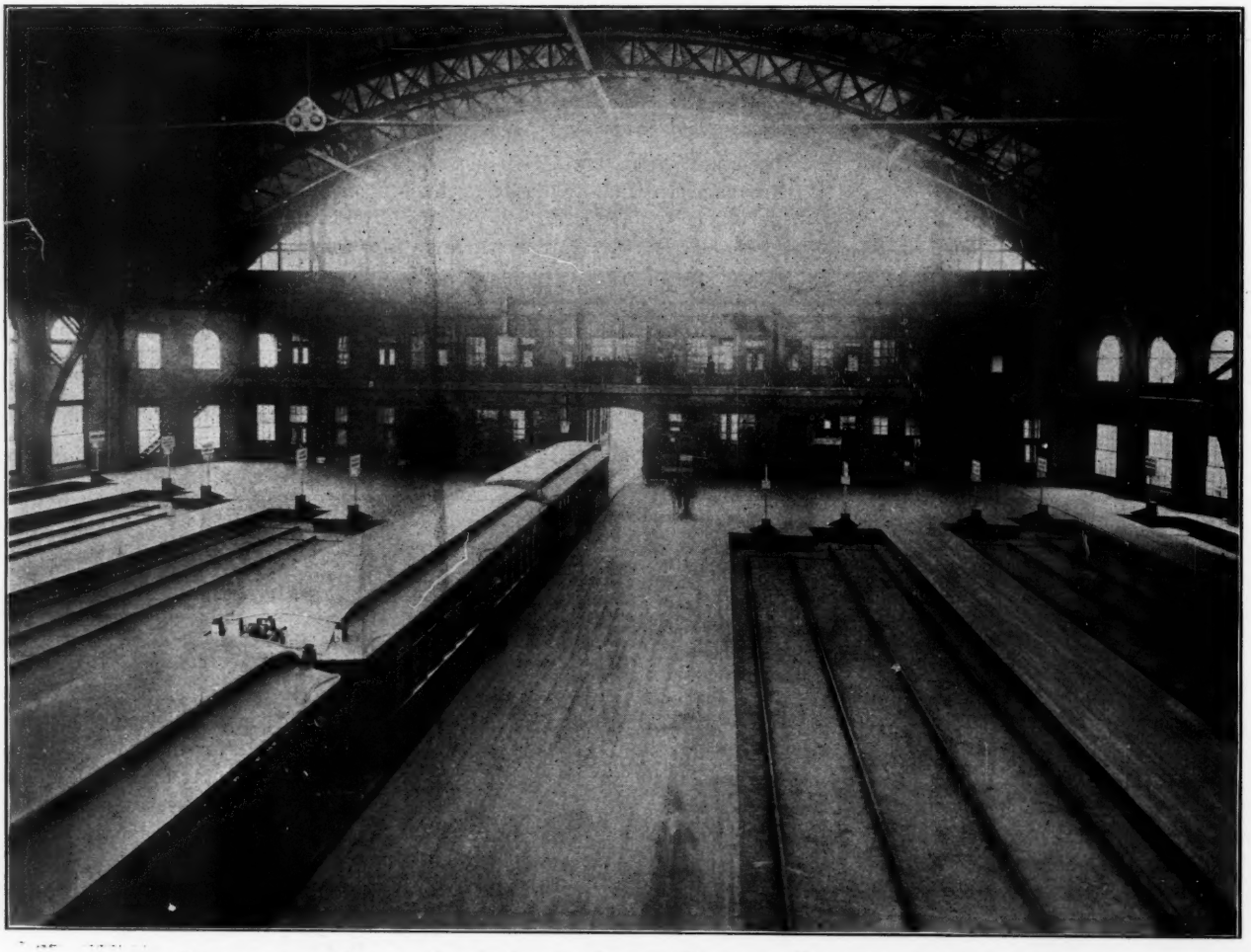
In addition to the system above described a certain proportion of the surface cars entering this station come in at the street level, the entrance for one set of such lines being shown in the view of the exterior of the building. Passengers connecting between these and the elevated trains or the surface cars going out from the second floor, must make use of a broad and easy flight of stairs.

At the other extremity of the elevated lines in Roxbury the conditions are not dissimilar. There, also, a loop of the elevated tracks has been installed and surface cars are brought into the terminal

station on two levels, as at Sullivan Square. The whole furnishes, in connection with the subway and the distribution line around the water front through Atlantic avenue, perhaps the most convenient and well-planned system of urban transit that exists in any city in the world.

ROLLING STOCK AND EQUIPMENT.

The company has at present 100 fully equipped motor cars of the style shown in the accompanying reproduction of a photograph and sketch side elevation. The cars are 48 feet long, over all, eight feet eight inches wide and have longitudinal seats and side doors, as well as doors opening to the end platforms. In general style they are similar to those which have been in operation on the Brooklyn Bridge since the completion of that structure. The entire equipment is fitted with the Sprague multiple unit system of control, each car carrying two motors and the platform controller of the Sprague system, while each is also fitted with an independent equipment of air-brakes manufactured by the Christensen Engineering Company, of Milwaukee, Wis.



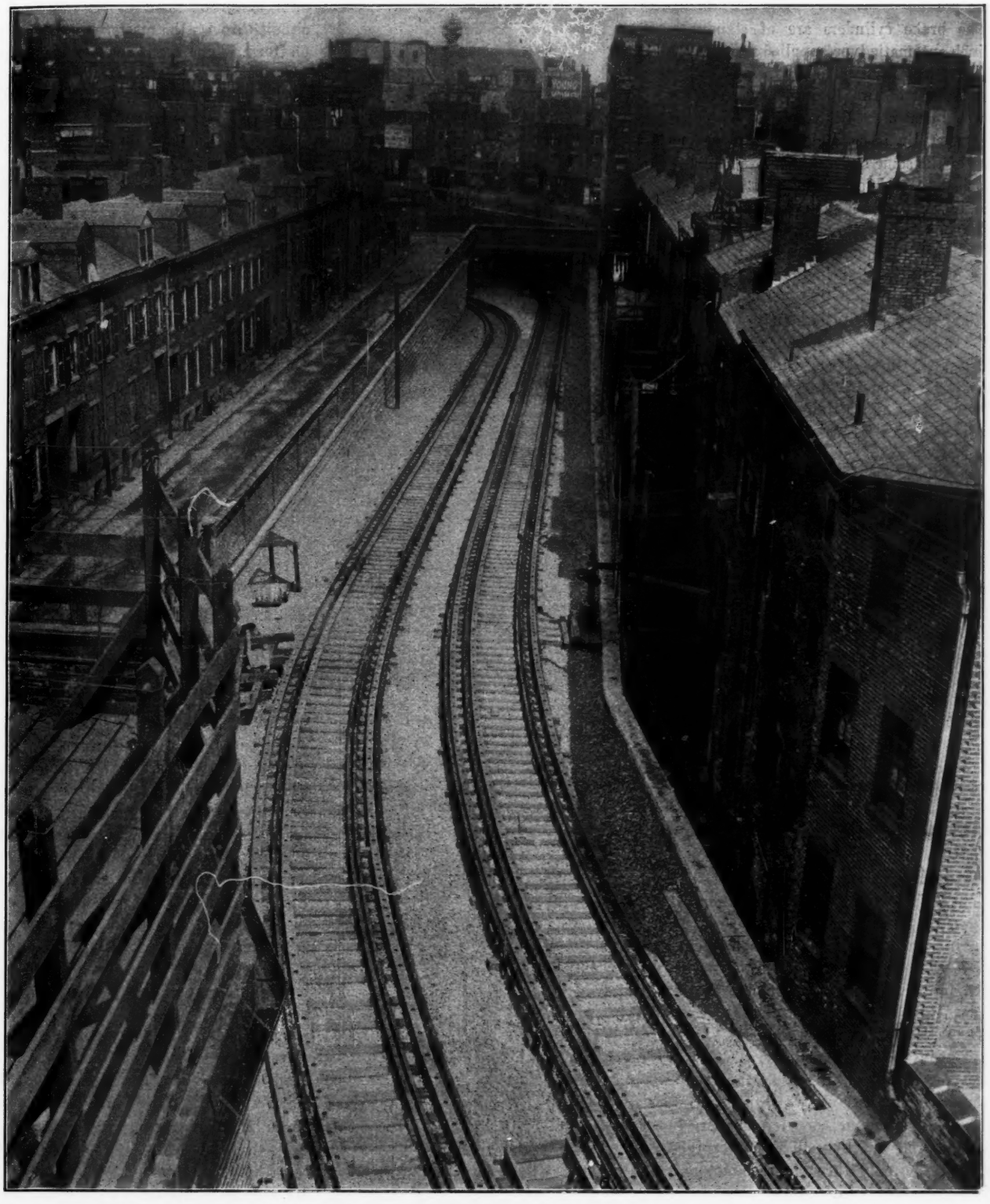
INTERIOR OF THE SULLIVAN SQUARE STATION, SHOWING TRACKS FOR ELEVATED AND SURFACE CARS.

For the air-brake system each car is equipped with a motor-compressor, an automatic controller, an air-brake cylinder with a triple valve, three air-tanks, two engineer's valves and two illuminated air-gauges. The motor-compressor has a capacity of 20 cubic feet of free air per minute and is a self-contained machine having all its working parts enclosed in an oil chamber. The motor is series wound and is geared to the compressor by means of helical gearing. The full potential can be instantly thrown on the motor without a rheostat. The armature is wound with machine-formed coils and, although the insulation test of the motor is high, the entire compressor is insulated from the other ironwork of the car, a length of rubber hose connecting it with the delivery pipe. The whole apparatus is mounted in a dust-proof box, suspended under the car. Oiling is stated to be required only once a month.

The automatic controller was designed especially for service with the multiple-unit system used on these cars. It operates automatically to start the motor compressor at a given minimum pressure and automatically to stop it at a given maximum pressure. The air is thus constantly kept within certain working limits. As a secondary purpose this controller is arranged to stop and start each motor compressor on the train simultaneously, and maintains a minimum flow of current from one car to another over what is known as the balancing-wire. At the same time a maximum resistance is maintained between this balancing-wire and the collecting shoes, so that in case of a cross between the balance wire and any of the control wires of the main motors sufficient current can not flow from the air-brake controllers into the train-operating mechanism to start the train. Arrangements are also made permitting of the detachment of any part of the train, so that each section of the brake equipment is complete in itself and will run as a unit in the same way as its electrical equipment does.

The first controller to be actuated by the reduction of air makes a ground for the relay coils on each controller of the train. These relay coils actuate switches which close the circuits for each individual pump. Thus each controller carries the current for its associated pump

only; and, when the ground connection above referred to is broken, each relay coil becomes inoperative, causing the switch on each pump to open and thus to break the current for the one pump only. The several arcs are extinguished by means of magnetic blow-outs. The controller is placed beneath a car seat in an asbestos-lined box. All parts of it are accessible and removable from the top, thus permitting of ease of inspection and repairing.



THE NORTHERN ENTRANCE TO THE SUBWAY, SHOWING INCLINE BY WHICH ELEVATED TRACKS ENTER, ALSO SHOWING CONDUCTOR-RAILS AND GUARD-RAILS.

In adapting automatic air-brakes to multiple unit trains two air-hose connections are made between the cars. One is for connecting the train pipe and the other is to connect the air reservoirs. Check valves are placed in the reservoir hose connections, so as automatically to close communication with the atmosphere in case of parting of the train or omission

to shut the cut-out cocks on either end of the train. Engineer's valves are placed on each platform of each car so that the train may be stopped or released from any of these points.

The brake cylinders are of standard 10-inch automatic type, supplied with four-inch triple valves. The main reservoirs each consist of two 14 by 45-inch seamless cold-drawn steel tanks and the auxiliary reservoir is a single 12 by 33-inch tank of the same style. Safety valves are attached to each of the main reservoirs. The illumination of the dials at each engineer's valve is effected by means of a small low-voltage incandescent lamp in series with one of the lighting circuits of the car.

The car body, including everything above the trucks, weighs 22,000 pounds and has a normal seating capacity for 50 passengers, while 120 passengers may be carried seated and standing. The trucks were designed and made by the Baldwin Locomotive Works, of Philadelphia. One truck of each car carries two 150-horse-power Westinghouse motors, while the other truck is simply a trailer. As much as 64 per cent of the weight of the car and its equipment is carried by the four driving wheels of the motor truck. This is equipped with 33-inch wheels, while the other truck has 30-inch wheels. Of the cars now on hand the larger part were built by the St. Louis Car Company, of St. Louis, Mo., although two other makers also furnished cars.

Upon the platform of each car is located a master-switch and the controller of the air-brake. This master-switch is such that no matter whether the cars are coupled in trains of one, two or of five, which is the probable limit, any controller operates simultaneously all of the motors. For control, three elements only are employed: A commutating switch changing the connections of the motors from series to parallel, a group of resistances and a reverser. Each motor has a single field coil—that is, electrically single—and in ordinary operation the steps of the control are as follows: The two motors are first put in series connection with a suitable resistance which is cut out until the two motors are left in series bridged across the line. The next point opens the circuit through the motors, either progressively through the resistances or instantly, as desired, throws the motors into multiple and in series with them inserts a resistance about one-quarter as great as that used when they were in parallel. Further movement of the controller cuts this out, leaving the motors

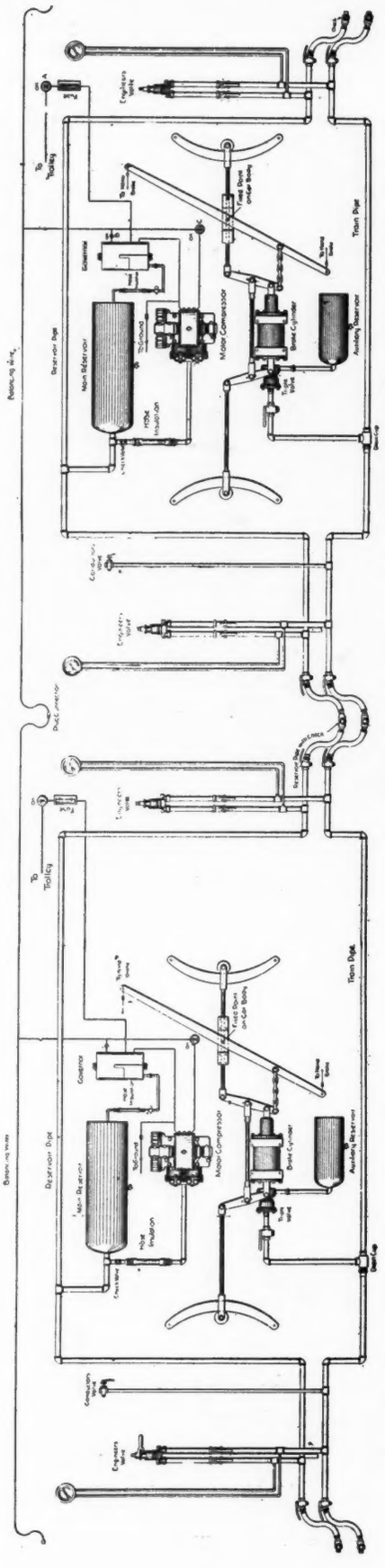


DIAGRAM SHOWING CONNECTIONS OF AIR-BRAKE SYSTEM, BOSTON ELEVATED RAILWAY.

in parallel bridged across the line and receiving the full potential for high-speed operation.

The controller proper is governed by a pilot motor operated by an independent circuit through the master-switch on each platform. The train line, or connection from car to car carrying the circuits of the control system, contains in all five circuits. The master-switch is of a cylindrical type, so arranged that right or left movement of a single handle, which is normally latched in a central position, produces ahead and reverse movements respectively of the car, and any desired variation of speed up to maximum. A spring connected with this handle automatically restores it to the central or off position when it is released by the motorman. The whole design of the switch is such as to insure high insulation and adequate provision against arcing or burning.

This switch operates a system of relays and automatic stops through which the pilot motor, working the controller, is itself controlled. The main controller is of an ironclad type and is made of ample size throughout and shows great simplicity of construction. It is in general of a type similar to that employed on street cars. The pilot motor drives the controller by a step-by-step movement through a powerful spring and locking pawl. The gearing through which the motor is attached to the controller is run in oil and great solidity of construction characterizes the motor and all of the working parts of the apparatus. The cars of the train are connected by couplers and jumpers so arranged as to exclude moisture and dirt from the contacts when these are made. The whole system is one which reflects most ample credit upon its designer, Mr. Frank J. Sprague, long known as one of the pioneers of electric traction. In operation the standard scheduled speed is 30 miles an hour over all, including stops, but 40 miles an hour may be made if necessary. An acceleration of two miles per hour per second in passing from rest to full speed may be attained, this being about all that passengers can conveniently stand and sufficient to insure very quick starts from stations.

Much of the credit for the design and construction of this fine system belongs to Mr. George A. Kimball, chief engineer of the elevated lines of the company, and to him, as well as to Mr. H. C. Hartwell, of the engineering force of the company, the ELECTRICAL REVIEW wishes to express its thanks for numerous courtesies in connection with the preparation of this article.

Governor Odell Speaks on the Advancement of Science.

Governor Odell, of New York, at a recent visit to Union College, Schenectady, N. Y., delivered an address in which were the following encouraging words to the young men of to-day:

THE NORTHAMPTON STREET STATION, BOSTON ELEVATED RAILWAY.

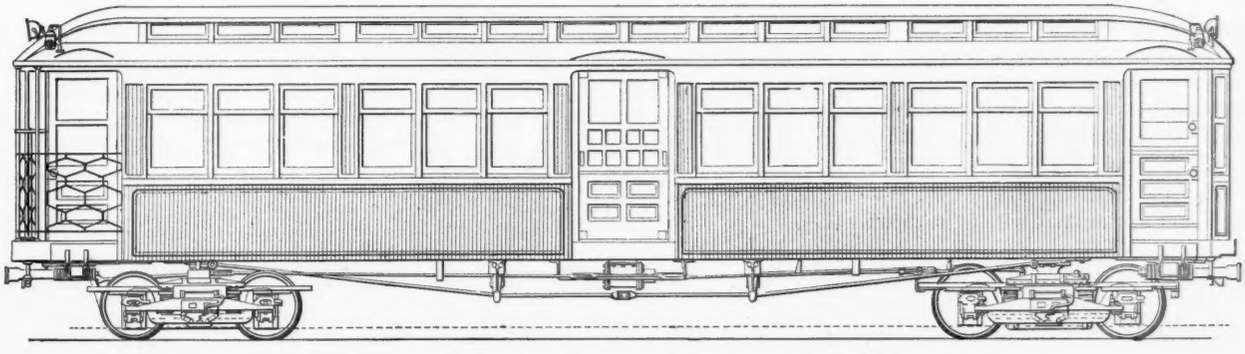
"Our universities, while not neglecting the classical branches, are devoting more attention to those studies which fit the youth for taking up life's work in a practical and intelligent way. Schools of engineering and mechanics have been established in connection with some of our universities and are being established by others. They are spreading broadcast that scientific and technical knowledge which is giving to America its preeminence in the world of finance, of invention and commerce.

"In this age of wonderful progress, of startling invention and commercial activity, we are apt to view with indifference the marvels of applied science. If we pause for a moment and view the achievements of the past century, the immense strides that have been made in every direction, we find that education has not been a laggard, that where are found the most progressive civilization and activity, there will be found the best institutions of learning.

"We hear the complaint made at times that, owing to modern business conditions, the young man's opportunities are passing away. I believe no statement could be more fallacious. Brains are always at a premium. The young man of brains, of integrity and of energy has to-day as great opportunities as ever existed in this or in any other country. There is no limit, save his own capacity, to what he may achieve, either in business, in politics, in science or in the professions."

The Musical Arc.

Herr Peukert has recently shown that in the musical arc discovered by Simon we have an exceedingly convenient means of producing alternating currents of very high frequency and moderate tension, says our British namesake. He made use of Duddell's arrangement of the circuits, with a choking coil in the main circuit to prevent the alternating currents leaking out of the shunt circuit in which they are produced. With the arc used in Peukert's experiments the pressure of the alternating currents was 42 volts, and the frequency 8,000 to 9,000. With the oscillating currents thus produced, all the well-known experiments of Professor Elihu Thomson were successfully repeated. Rings of aluminum and copper were caused to float above the end of an electromagnet energized by the currents; glow lamps short-circuited by a bent wire were readily incandesced; and the surface concentration of alternating currents was demonstrated. As an example of the last-mentioned effect, an iron wire 12 millimetres in diameter had its apparent resistance increased 29-fold. Peukert has discovered that no telephonic or other vibrator is necessary to start the oscillations in the shunt circuit of the arc. All that is necessary is to close the circuit, whereupon the electric oscillations start automatically, and continue while the arc is of suitable length. When, however, the length of the arc is increased beyond a certain limit, the oscillations cease, but are reestablished when the length is again brought within the working limit.



SIDE ELEVATION OF STANDARD CAR FOR BOSTON ELEVATED RAILWAY.

THE IMPORTANCE IN TELEGRAPHY OF APPARENTLY LITTLE THINGS.*

BY THOMAS D. LOCKWOOD.

The telegraphic circuit in working condition comprises three essential parts, the source to produce the electrical current, the conductor to be traversed by the electrical current, and the station instruments to manifest the electrical current.

Let us consider the conductor first. This may be regarded as including the line and office wires. Ninety cases out of a hundred, at least, the line wire is iron; and when that is the case the joint is the part mainly to be looked after. If I should lay down a set of conditions about the grade of wire, the tensile strength and the maximum resistance per unit of length, they would be of little or no use to anyone having their wire delivered to them; and being in the condition of having to take this wire or no wire, or having to accept wires already strung. But it is never too late to attend to joints. After many years of considering and using joints in iron wire, and after careful comparison of the regular twist joint of the United States lineman and the Britannia joint, I feel free to say that I think the twist joint, soldered, is the better of the two, all things taken into consideration. For it is not only simple to make, but holds well, is comparatively easy to solder, and leaves no projecting points. The short projecting ends of the Britannia joint would, I think, on our lines be productive of trouble, as tending to hook neighboring wires, thus introducing crosses. But, unquestionably, iron wire joints ought always to be soldered, at least when the wire is first strung; and I believe in a general soldering campaign at intervals, say, of three years. Such a practice would tend to economy alike in battery power, time in operating, and profanity.

Copper is a thing apart. The twist joint, in my opinion, ought not to be employed with it, nor should copper joints be soldered. There is too great risk of burning the wire. Either the two-sleeve MacIntyre joint or the three-wire joint should be employed.

And while it seems a thing that every one stringing copper wire ought to know, it is a fact that every one does not know, that in the attachment to insulators of copper line wires, copper tie-wires must be used.

The glass insulator seems to have become standard with us; and in a country generally so dry as is ours, it is probably good enough. I think it a question, however, whether carefully tested porcelain insulators would not, along the coast, and for some 50 miles inland, be a material improvement. But it is to be understood that when I say porcelain insulators, I do not refer to the porcelain door-knob abominations which are sometimes—I fear far too frequently—used by constructors of a saving turn of mind.

I have sometimes seen office wires festooned loosely and carelessly all over the wall, instead of being properly stretched and neatly secured. This is only a little thing, but it proves that the wireman who connected them was a careless and neglectful man, who will some day be sure to cross-connect a main with a local circuit, or perform some like enormity. I have even seen bare wire used on the walls and table of an operating room for office wire. Where but a single wire enters an office, as good a way as any is to screw up porcelain picture-hanging knobs on the wall, and to run the office wire from knob to knob as far as the switchboard or cutout, tacking it the rest of the way. In tacking, a poor wireman will be under a strong temptation to put two wires under one staple, but that particular temptation must always be resisted.

A young and enthusiastic operator naturally likes to have his table present a tasteful appearance, and even spends money from his own all too scantily filled pocket to buy an oilcloth cover for the table on which the instruments are to be placed. The wireman comes and connects the instruments all right, but there is an escape or partial cross in that office which, until removed, sadly interferes with the working of the line. I think it likely that others here, besides myself, have introduced a trouble by means of a painted or oiled table cover to which the key was screwed; and while the desire to have a neatly arranged office is laudable and to be encouraged, oilcloth covers for instrument tables are to be looked after, and generally discouraged.

This brings us to the consideration of instruments. Beginning with lightning arresters, so-called (although since lightning was never known to be arrested by anything, the term seems to be a misnomer), I think there are still a goodly number in use, of the old-fashioned style, wherein a piece of paper or similar poor conductor is placed between two plates having conductive relation with the line and ground respectively. A little thing to be looked out for in these is a fault not infrequently occurring after a lightning storm. The operator sees a bright flash, and hears a sharp crack as of a pistol shot. But as his relay is not burned out he thinks that no harm is done. But an escape has appeared on the line which presently is located in his office; and it is then found that a spark has perforated the paper and that a partial contact has been established through the carbonized edges of the perforation between the line and ground plates. After the flash and crack, of course this should have been looked to.

In operation, also, we can well look after small matters. I have known reputable operators to adjust with a very slack armature spring, and a distant magnet; others to adjust almost altogether by the magnet screw; others again to prefer a moderately slack armature spring, and a moderately distant magnet. Yet, although I have found many who did not know it, the best results, as is evident by applying intelligent thought, are to be attained by working with the magnet as close to the armature as can be arranged without taking the chance of straining the latter; to adjust the limit stops so that while the armature is thus close it can never absolutely touch the magnet cores; to keep the magnet adjustment generally permanent; to have a highly adjusted armature spring, and as far as possible to adjust altogether by such spring. For when this is done, we make the most of whatever current there is on the line and thus get a snappy forward attraction, while the tight spring gives an equally sharp reaction. Any temporary readjustment can be much more effectually done by adjusting the spring than by changing the position of the magnet.

Sometimes a relay otherwise good will exhibit signs of residual magnetism, and will thus become difficult of adjustment. A very little change will often remedy the effects of this phenomenon. This is to transpose the main wires and relay binding-screws, so that the direction of the current through the relay winding is reversed.

In the matter of batteries, we may surely assume that at stations where there are main batteries, there must always be some one of requisite skill to look after them; and that we may therefore restrict our considerations to local batteries. The care of these, of course, should be understood by every operator; but, alas, it is not.

Often a local battery is allowed to remain without attention far too long; and is at last only taken apart, cleansed and renewed because it is actually unable to

* Extracts from a paper read before the Railway Telegraph Superintendents' Association, June 20, 1901.

work any longer. When disconnected, if it be one having porous cups, it is found that the substance of the cup in a number of places is plugged or filled up with crystalline copper, and that the porousness is, to a corresponding extent, impaired. It is well to remember in setting the battery up again that these copper incrustations and deposits may be prevented in a new cup, and diminished in an old one, by the simple expedient of so placing the zinc that it shall not touch the bottom or sides of the cup.

In batteries—local batteries in particular—it frequently happens that the connections or screw clamps between the cells are allowed to oxidize, or to become covered with crystalline accretions; this last in the case of potassic bichromate batteries especially, and the crystals in such batteries, being chrome alum, are non-conducting and insoluble.

Every operator at every station, however important or unimportant, should know when and how to take a battery to pieces, and how to clean it and set it up again. I fear that all operators do not. Every operator should know that in a blue vitriol battery the solution of zinc sulphate should be strong enough, but not too strong; and that the current is unduly weak, both when the zinc solution is too weak, and when it is too strong.

When gravity batteries are used and there are no covers to the jars, there is a very great tendency to evaporation. When I first worked with gravity batteries I was told this, and was also told that to counteract such tendency, a layer of crude cotton-seed oil must be poured over the top of the zinc solution. But crude cotton-seed oil is a most abominably filthy article; and after thinking the matter over, I decided to try melted paraffine in its place. This answered the purpose admirably, quickly solidifying in a thin covering over the liquid. But it is too dear for general use, and I presently found that tallow makes a very good substitute. It prevents evaporation, and when the cell is to be cleaned, the film of tallow can with ease be cut cross and round, and taken off in two or three pieces; exactly as a cook would remove flakes of congealed fat from the surface of cooled soup.

Sometimes a LeClanche cell with sealed porous cup will not work at all satisfactorily. It seems as though the cup, though really porous, is utterly impervious to the battery fluids. When this happens, it is probable that the vent holes in the sealing have been stopped up. This being so, the remedy is to run a pointed iron or steel rod, such as a fine screw-driver, through the holes into the mixture so that the gas can escape. But if the so-called porous cup be really too hard or glazed, it can be made to work by boring several holes through its sides.

The Erie Telephone Properties and Their Future.

The $26,300,000 valuation placed on the Erie Telephone properties by Messrs. Stone and Webster, being, in their judgment, an estimate of what it would cost to duplicate the property to-day exclusive of rights of way and franchises, shows that the Erie funds have been well invested. To this sum, a fair value of rights of way and franchises, provided this could be obtained, adds $6,000,000, making the total valuation of the property $32,300,000. Nearly all of the Erie's 95,000 miles of long-distance wires are built upon rights of way purchased and owned absolutely by the company, and not on the highway, while an equal amount of exchange wire, 95,000 miles, is underground.

The Eastern Audit Company has completed its examination of Erie Telegraph and Telephone Company's treasurer's accounts in eastern offices at Lowell and Boston and are now at the division headquarters of the several subsidiary companies in the West engaged in checking the accounts with the treasurer's books. This work will be completed about September 15, and, with the physical report, will form a basis upon which a plan will be devised to pay the $7,500,000 loan due January 10, 1902, and arrange for the money that the company will require for the next year and determine the rate of dividends for the future. All these matters will be considered at the regular meeting of the directors the latter part of September.

The Erie companies' gross earnings for the first four months of 1901 are $400,000 more than the corresponding months of last year. May's growth in subscribers, 3,564, is one of the best the company has had and the 150,000 mark for total number of subscribers has now been exceeded by 144. While the policy of the new management is not to make any extraordinary canvass for subscribers, all regular applicants for profitable service are receiving prompt attention. The natural annual growth should be at least 25,000, but the cost of connecting will be largely reduced from the fact that ample facilities for a large growth were provided during the past year.

A gentleman interested in Erie says that the appointment of John I. Sabin as the head of the Chicago and Central Union companies, and the proposed increase in American Telephone stock pretty well indorses the Erie policy of development and shows the plan of the future for telephony, which can be nothing less than a rapid and complete development of the territory. This gentleman also said: "I have been receiving Erie dividends 17 years and have no reason to doubt that the present management will provide for construction and continue dividends when they ascertain the earning power of the properties."—*Boston News Bureau.*

Platinum in Antiquity.

Professor Berthelot reports in a recent number of the *Comptes Rendus* that on a metallic box from Egypt, covered with inscriptions, he found a portion of one of the characters made of platinum. The mass was too small for a complete analysis, but from its behavior toward aqua regia, it appeared to be native platinum. The date of the box was about 700 B. C. From two standpoints this discovery is of more than passing interest. It has been a much disputed question whether platinum was known to the ancients. Passages from the classics have been quoted which appear to some to be references to platinum, but this application is in every case very doubtful. A much stronger argument against the probability of platinum being known more than a few centuries ago, is, that until this discovery of Berthelot's, no trace of the metal has been found in any ancient remains. Had platinum been known, it is hardly conceivable that specimens of it should fail to be found somewhere among the multitudinous remains of antiquity. This present discovery really emphasizes the argument, for it would seem from the description given by Berthelot that this specimen of platinum was used by the workman unwittingly, resembling as it does some of the pale gold of Egypt. A second interesting point is that if Berthelot's conjecture be true that this is native platinum, obtained from the alluvial deposits of Nubia or the upper regions of the Nile Valley, it is the first recorded occurrence of platinum in Africa, with the single exception of an observation of Aimé, in 1838, that some of the galena from Algeria contains a trace of platinum.—*Science.*

Power from Waste Gases.

Utilization of blast-furnace gases for power has made rapid strides in Germany, where more than 40,000 horse-power is furnished by gas engines working on these gases.

Don't talk into your friend's other ear when one of them is listening at the telephone receiver. It is liable to provoke profanity meant for you but heard by the party at the other end of the telephone wire and possibly by the young lady at the central office.

NOTES ON THE CONSTRUCTION AND PROTECTION OF AERIAL TRANSMISSION AND DISTRIBUTION SYSTEMS—I.*

BY K. B. THORNTON.

In this country the majority of transmission and distribution systems are of overhead construction, and are likely to remain so for many a long day. As these systems are exposed to all kinds of weather it is a matter of great importance to those who are operating the same that they be constructed and protected in the best possible manner. Aerial lines are constructed by placing wooden or iron poles in the ground generally at distances varying from 105 to 120 feet apart in cities, and from 90 to 100 feet apart for high voltage transmission lines in the country.

For wooden poles, cedar wood, owing to its lasting qualities, is generally used up to lengths of 50 or 55 feet; beyond this length they are hard to get of suitable proportions, the tops being often too small and the butts too large, and the price prohibitive. Apart from this, cedar is also too brittle a wood to use for high lines. Spruce and pine poles are therefore used where lengths over 55 feet are required, chestnut and other desirable woods not being obtainable in this country. As it is daily becoming harder to get long poles it is often necessary to resort to splicing poles to get the proper lengths.

Good cedar poles will last for 20 years and more without showing any signs of rotting, but red pine poles will generally rot at the butt in cities in less than 10 years, and spruce poles often show signs of rotting in four or five years, depending very much, however, on the nature of the ground in which the pole is located.

With a view to increasing the life of spruce and pine poles it is customary when placing them to coat the butts with a heavy coating of tar. The length of poles is governed by the conditions of locations. They are usually from 40 to 65 feet, and to clear high buildings, from 75 to 80 feet. Experience has shown that it is advisable to keep the lengths of the poles as short as possible, as they are less exposed to the weather, and it is generally a hard matter in cities to guy them.

Throughout residential and suburban districts and for transmission lines through the country the usual length for poles is 40 feet. The following are some of the essential features of a pole contract:

Poles to be of good, sound, well shaped line cedar wood, not less than seven inches in diameter at the small end.

Poles to be cut square at both ends and the bark stripped off clear from the top to within six feet from the butt, and all knots to be neatly trimmed off; no pole will be accepted with two curves in it.

Poles will be inspected and branded at point of shipment, the inspector having the power to reject any pole that he may consider to be unsatisfactory.

Shaving Poles—Poles when unloaded at the pole yard are inspected and shaved, the cost of shaving averaging about three-quarters of a cent per foot.

Setting Poles—In regard to the setting of poles no regular rule can be given for the depth which they should be set in the ground; usually it is from five to seven feet, depending on the height, location and the condition of the ground in which they are located.

The following are the usual depths of setting in good ground:

Height of Pole.	Depth of Setting.
35 to 45 feet	5 feet.
50 to 55 feet	6 feet.
60 to 80 feet	7 feet.

In marshy or "made" ground, it is often necessary to concrete the butts of poles, using a mixture composed of one part of cement, three parts of sand and five parts of broken stone.

Up to a height of 45 feet poles are set with pike poles and a dead man, and over that height with a derrick.

The number of men being as follows:

Height of Poles.	No. of Men Required.
30 feet	6 with pike poles.
40 feet	7 with pike poles.
60 feet	10 with derrick.
70 feet	15 with derrick.
80 feet	15 with derrick.

Should the poles be wet one or two additional men may be required on account of the extra weight. The gains are cut while the pole is on the ground, and also when used in cities the holes drilled for spikes.

When a pole is once set the earth is well tamped around the butt; this is especially necessary in the early spring, when the frost is not quite out of the ground, and if not properly attended to the poles will get out of line in a very short time.

Spikes are of square wrought iron, nine inches by nine-sixteenths inch, two men being able to drive about 500 per day of 10 hours once the holes are bored.

Cross-arms are usually of red or yellow pine, and vary in length, for ordinary city service, from two feet six inches for a two-pin arm, about eight feet for a six-pin arm, and have a sectional area of three feet four inches by four feet four inches for all ordinary work; for transmission lines the dimensions will vary from the above, depending on the nature of the transmission service.

Cross-arms are rounded or chamfered on the top side to prevent water gathering and lag-screwed to the poles with seven-inch by one-half-inch lag-screws. Some prefer to fasten the cross-arm with bolts passing through the poles, but our experience has been that it is easier to replace cross-arms that have been lag-screwed than those which have been bolted, as the bolts generally rust, making it necessary to use a drift to drive them out.

Braces—All four and six-pin arms should be braced with flat iron braces not less than one and one-quarter inches by one-quarter inch by twenty-seven inches, bolted to the cross-arm by four-inch by three-eighth-inch machine bolts at one end and either lag-screwed to the pole with a four-inch by three-eighth-inch lag screw, or bolted to the next cross-arm underneath.

On important transmission lines with long and heavy cross-arms, where very strong work is required, braces of angle-iron in one piece are sometimes used.

A brace composed of one piece has some distinct advantages; for instance, some time ago one of the wires on a high voltage transmission line slipped off the insulator onto the cross-arm, and the current to ground through the pole burned the cross-arm clean off the pole, leaving the two outside ends of the arm supported by the brace, permitting the service to remain uninterrupted until such time as the line could be conveniently shut down.

Pins are fitted in holes drilled in the cross-arms about 15 inches apart and 22 inches between the centre two pins, and secured by a wire nail driven through the cross-arm.

After considerable experience with oak pins they have been abandoned in favor of one and one-half-inch locust wood pins, it being found that oak pins after five or six years were inclined to rot and break off at the shoulder when subjected to any great strain.

Where great strength is required at corner poles or for dead-ending, it is advisable to use solid iron pins.

On long, straight runs it is advisable to set the cross-arms in such a way that they alternately face each other on adjacent poles and are back to back on the next two poles; in this way, should a stretch be cut down or a pole break, there is less danger of the cross-arms being wrenched off than if they were all set in the one direction.

At all long stretches, corners, and for dead-ending, cross-arms should be doubled, with a spacing block at either end of same

*A Paper read before the Canadian Electrical Association, June 20, 1901.

and fastened at the ends by bolts run through the spacing blocks.

Insulators—For regular line voltages of 2,000 to 3,000 volts, the ordinary deep-grooved, double petticoat glass insulators are used; for higher voltages it is necessary to use specially prepared triple petticoat insulators of porcelain or a combination of porcelain and glass, so proportioned as to give the greatest distance between the point of support of the wire and contract with the pin and at the same time permitting of a minimum amount of surface leakage.

These insulators are ordinarily subjected to a breakdown test before being placed, in order to locate defects.

Wire—For all ordinary line work, soft drawn copper wire is preferable to hard-drawn, the disadvantages in using it due to increase of sag being more than offset by the difficulties in handling hard-drawn wire and the possibilities of damaging same when it is being erected.

As yet aluminum has not come into general use for overhead construction owing to the difficulty of making proper joints and the greater size of the conductor necessary to get the equivalent conductivity of copper.

It is customary on city lines to use wire insulated with a double braid of cotton thoroughly saturated with an insulating compound.

Rubber-covered wires for line work are of no use, as the insulation will deteriorate in a comparatively short time, when exposed to all kinds of weather, rendering it worse than useless.

Tieing—The line wire is secured to an insulator at each cross-arm, being laid in the groove of the insulator and tied with a short length of wire about one or two gauges smaller than the line wire.

Jointing—The ordinary twist joint is used except on very heavy wires of No. 000 gauge and over, when it is better to use a lap joint, as it runs over the cross-arms easier when the wire is being strung.

Dead-Ending — Lines are generally dead-ended on double cross-arms, the wire being twisted around the insulators and then back on itself, and the tie wires soldered to the line wire on the last two or three poles. (Fig. 1.)

For high-voltage lines a dead-ending arrangement, consisting of a series of globe strain insulators, is sometimes used, the line being fastened to one end of a string of strain insulators, the other end of which is bolted through the cross-arm, as shown in Fig. 2.

This system of dead-ending is not altogether satisfactory, as the insulation of the strain insulators deteriorates and breaks down.

Fig. 3 shows another method for dead-ending high-voltage lines which has proved

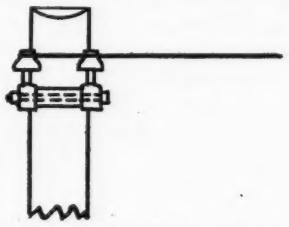


FIG. 1.—DEAD-ENDING LINES.

to be very satisfactory, although more expensive than that shown in Fig. 1.

With this arrangement the wire is tied around two insulators, supported on a special iron bracket which is bolted through the cross-arm, the centre of the wire being in fine with the shank of the bracket.

Stringing Wire—Wire when strung is

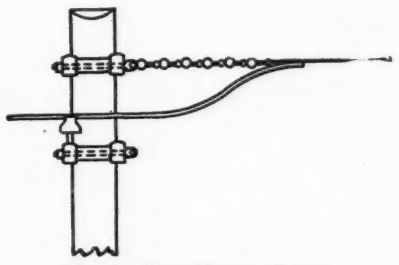


FIG. 2 —DEAD-ENDING LINES.

subjected to mechanical strains due to weight, tension, variations in temperature and additional weight in winter due to ice, and when stringing wire in our Canadian climate special allowance must be made for variations in temperature.

Dynamometers are not ordinarily used to determine the tension of the wire strung, but experience has shown what sags to allow between poles for different sizes of wire.

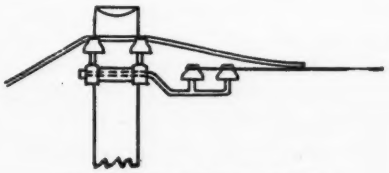


FIG. 3.—DEAD-ENDING LINES.

The deflection of a wire supported between two points is given by the formula:

$$d = \frac{L^2 W}{8 T}$$

Where

d = vertical deflection at middle of span.
L = length of span.
W = weight of wire in pounds per foot.
T = maximum tension of wire in pounds.

The length of a wire in a span is given by the formula:

$$L_1 = \frac{L + 8 d^2}{3 L}$$

Where L_1 = length of wire and L = length of span

$$\text{or } d = \sqrt{\frac{3 L (L_1 - 1)}{8}}$$

Stresses—Pole lines are subjected to various stresses which have all to be provided for.

These stresses are firstly, those due to the weight of the conductors and fixtures on pole, or the weight of ice on the conductors together with their weight tending to crush the pole, and secondly, those due to the lateral pressure of the wind on the pole and conductors, tending to break the pole by bending; the action of the wind also has the tendency to break the pole near the ground due to vibration.

The danger due to crushing is not very great as there is always a very large factor of safety.

On one of the heaviest pole lines in Montreal the factor of safety for crushing under ordinary conditions is about 400. Once, during the winter, after a very heavy sleet storm, this factor was reduced to about 240, owing to the extra weight of ice on the wires.

The stresses, however, which are most to be feared, are those caused by wind.

The same pole line mentioned was blown down in November last during the last hurricane, about eighteen 70-foot poles being broken.

McGill Observatory reports gave the velocity of the wind at 75 miles per hour, which is equivalent to a pressure of 25 pounds per square foot. This represented a total pressure on each stretch of this particular line, of 3,750 pounds, and there is no doubt if this had been applied as a constant pressure, that the poles and guys would have withstood same. However, the combination of the wind and the swinging of the wires evidently produced a strain in excess of the strength of the poles and guys.

Electrolytic Chlorates.

The annual electrolytic production of chlorates is about 12,000 tons, employing altogether about 25,000 horse-power. The principal factories are at Saint Michel de Maurienne, Chedde and Vallorbe, Switzerland; Monsboe and Alby, Sweden; Niagara and Bay City, Mich., in the United States, and Rheinfelden and Bitterfeld in Germany.

THE APPLICATION OF STORAGE BATTERIES TO RAILWAY TELEGRAPH SERVICE.*

BY W. E. ATHEARN.

The importance of uninterrupted telegraph service for the handling of trains almost precludes the trial of any new departures, and what might be termed ultra-conservativeness, may, after all, have been the most prudent course to pursue. This, I think, probably accounts for the limited use to which the storage battery has been put, up to the present time, in the railway telegraph service. It has, however, been my good fortune to be connected with the Western Union Telegraph Company, where there are so many wires and so many battery stations, that the failure of any one of them could be quickly taken care of by supplying current from other near-by battery centres. One or two copper wires, with their low resistance, serve readily for battery leads for points many miles apart.

At the Jersey City terminus of the Central Railroad of New Jersey, in 1894, there were 500 cells of gravity battery, maintained for locals, and for the railroad wires that did not cross the river to the Western Union main office in New York. This seemed an excellent place for trying what might be termed the experiment of substituting storage for gravity batteries for the railway telegraph service; as passing through that office are more than 100 Western Union commercial wires, and I assured my friend, Mr. Robert Stewart, at that time superintendent of telegraph for the Central Railroad of New Jersey, that it was definitely understood, that, in case of failure of the proposed storage battery, the Western Union would send him power from their dynamo plant in New York, to operate the railroad wires. With this reserve to fall back on, he readily gave his consent. I am pleased to be able to say that, in the seven years following, they have never had to call on the New York office for help. The railroad company furnished power for charging these batteries from their own electric light plant, and gained in return the use of nearly all the space formerly set aside for a battery room, as the storage cells are small, only about four inches square, and less than 100 in number.

Their lighting plant, in clear weather, runs only at night, and the power taken for the storage batteries is about what would be required for two incandescent lights. There are two distinct sets of batteries for the main lines. One set furnishes current to the telegraph wires for 24 hours and is then put on charge over night, while its companion bank of cells takes care of the telegraph service during the succeeding 24 hours. This makes the work easy for both banks, and would permit the maintenance of the service for four days, even if their electric light plant should fail and no fresh charge could be put into the cells for that length of time. The locals are also taken care of by the use of four cells of 125-ampere-hour capacity. Two cells charge in series and discharge in multiple. One leg of the electric light branch, that furnishes light to the operating room, is looped down so that all the current passing to those lamps also passes through the two storage cells in series. This creates a back pressure, dropping the voltage of that particular room from 110 to between 105 and 106 volts. Lamps of the latter voltage are used, when full candle-power is expected from them. The reason for using four cells instead of two, is that the current, in that particular branch of the light service, would not put sufficient charge into one storage cell, to enable it to supply the 20 or 30 four-ohm sounders they require in their service.

It would be poor engineering if we had to burn lamps at 110 volts when we did not need them for light, but simply required some 2½ volts per cell for charging the storage batteries. The first cost of the storage plant required for the displacement of the 500 cells of gravity battery was a little under $200. No expense was entailed for the first two years, when a new set of positive plates was put in at an expense of less than $100. At the end of six years a complete set of new cells was furnished, but many of the old cells are still in use where the demands for capacity are lighter.

Letting the saving in battery room space and the labor of cleaning offset the cost of the charging current, it will be seen that the total expense for six years was $300 for storage battery service, whereas it would have cost $3,000 to have maintained the gravity batteries for that length of time, allowing an expense of $1 per year for each gravity cell. I have dwelt somewhat in detail on this particular installation, as it is one of the oldest with which I have been connected. Since that was put in service I have installed nearly 100 other plants, and have seen no reason for modifying my views as to the great economy, both as to actual cost and as to the labor involved, in keeping the plants in efficient operation. At first I paid regular and frequent visits to the various installations under my care, but with the development of more perfect batteries I have found this unnecessary, and I have some thousands of cells in daily use that I have not seen in two years' time. In fact, some storage batteries have been put in at remote points, where no lineman is stationed, for the very reason that they will maintain constant service with so little attention. My instructions, when setting up these small plants, are for the operator to reverse his switches once every 24 hours, and, as often as once in three months, to look at the batteries and add water if needed, to keep the plates covered by the solution.

No small plants, say where there are not over 300 cells, have any meters, but when setting up the batteries I calculate the output demanded by the wires they are to feed, and set the charging rate so that it will be sufficient for a week of foggy weather. In large installations it pays to have meters, as much less current is taken by the telegraph wires in dry weather, and the charging current can therefore be reduced, and enough saved to eventually pay the cost of the meters.

Another point is this, that special care should be taken in the construction of the battery stands.

With gravity batteries we have always thought most any old thing would do, so long as it was strong enough to hold up the cells. I started in using the old gravity stands, just as I found them, but before long I began to get complaints that there was a great deal of escape put on the wires, whenever a storage battery was cut in as an intermediate battery. I soon found that wherever a little solution had been spilled, or any leaked out from a cracked jar, the wooden shelf was turned black, and reduced to almost a state of punk. A wooden shelf in such a condition, is a fairly good conductor in itself.

Always bear in mind that the insulation of the cells, and the style of wiring adopted must be carefully attended to as for any regular electric light work. Be sure, also, that a fuse is put in with each bank, or group of cells, for while they look harmless, they have an enormous amount of energy stored up in themselves, and a short-circuit would mean the almost instantaneous melting of the wires, unless there was a fuse to protect them.

* Extracts from a paper read before the Railway Telegraph Superintendents' Association, June 20, 1901.

Ferro-Titanium.

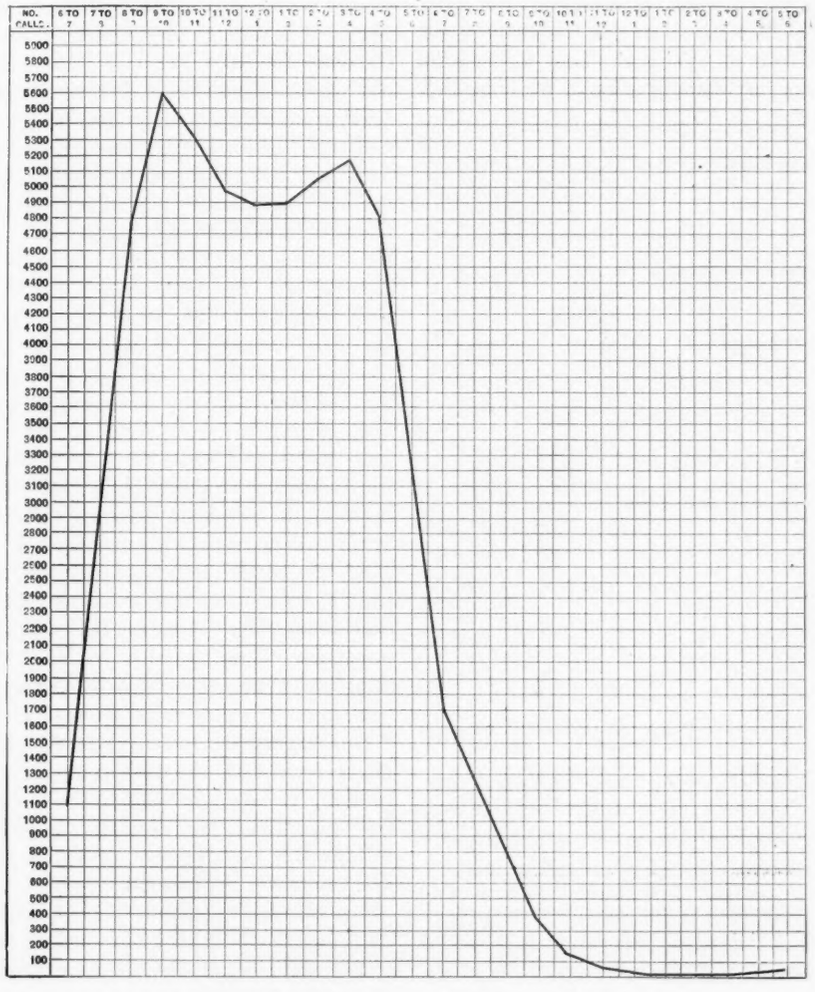
One of the electrometallurgical establishments at Niagara is undertaking the preparation of ferro-titanium in the electric furnace. In the tests 550 pounds of the metal have been made in 24 hours.

TELEPHONE EXCHANGE SERVICE.*

BY L. W. STANTON.

This subject may be divided into three important branches: reliability, promptness and good transmission. Any of these, if not up to the highest state of perfection, mars the general result.

The first of these, we all know, is of the utmost importance, for the business man of to-day will not for a moment tolerate unreliable service.



THE DAILY LOAD CURVE OF A TELEPHONE EXCHANGE.

The second, promptness, is an essential quality of popular service. There is nothing more annoying to the modern business man than slow service. When he steps to the telephone, he expects an immediate reply, and if he is compelled to wait even for a short time he is very likely to become dissatisfied with the service.

For good transmission as well as apparatus we must depend upon the manufacturer. The Independent telephone interests are to-day in greater danger on account of some of the inferior apparatus that is being thrown upon the market than they have ever been from the old monopoly. Some of the apparatus that is being sold to-day by the Independent manufacturers is a curse to independent telephony. It only half works; it is unreliable; it does not give good local service, not to mention the poor results obtained when used for long-distance lines. Every telephone that is installed to-day should be one over which conversations between New York and Chicago could be carried without difficulty, for it is only a matter of a short time till every telephone in this broad land will be connected by a net-work of long-distance lines to every city, village, town and hamlet. The continued use of inferior apparatus will mean unreliable service, poor transmission, expensive maintenance and a final discarding of the original installation at a great loss, and, worst of all, dissatisfied subscribers. I feel sorry for the Independent interests when I see this inferior apparatus being installed in exchanges that are being newly equipped. It is true that it is difficult for the Independent telephone companies to select the best apparatus, for, as a rule, their experience has been limited to the use of apparatus that was furnished them a few years ago. Another reason is the unparalleled strides that have been made in telephone manufacturing within the last few years. They have been accustomed to the old magneto drop board, which is undoubtedly a thing of the past in exchanges of any size. It is the opinion of the writer that in any exchange of over 100 subscribers, where suitable arrangements can be made for current, the only thing to install is a central- energy lamp-signal board with double supervision. This style of board saves an operator a great many moves, such as restoring line signals, and cutting in on subscriber's line to inquire if party answered, or if the subscribers are through talking; for with double supervision she can tell at a glance whether the called-for party has answered, or if the conversation is finished.

Wherever an exchange requires three or more operators a multiple board should be installed, for when transfers are used they impede the service and add permanently to the operating expense. On a large transfer board you almost double your work, for nearly every call has to be trunked to a second operator, while with a multiple board each operator handles her subscribers' calls direct and without assistance. Another distinct advantage of the multiple board is that one operator in the evening and on Sundays can sit at one position and answer all calls through the multiple. In this way, with double supervision, she has control of the entire board.

I do not doubt that some of you are of a different opinion, but I will endeavor to show why this class of apparatus is superior.

It gives better service.

It is cheaper to operate: First, because it requires fewer operators. Second, because it dispenses with hundreds of local batteries scattered over miles of territory. Third, it does away with an expensive piece of mechanism, the generator, with its cog-gears, shunts, commutators, etc., which are a constant source of wear and tear. Fourth, in eliminating the generator and batteries the number of inspectors can be reduced, which is no small item.

The following figures will give some idea of the saving in the cost of current for an exchange of 1,000 subscribers. Taking the cheapest form of battery, which is the dry cell at 15 cents each, and using two cells per telephone, which is modern practice, it gives a cost of 30 cents

* A paper read before the Independent Telephone Convention, June 13, 1901.

per telephone. Allowing the battery a life of one year, which is more than the average, we have a cost of $300 per year, or $25 per month for the 1,000 telephones.

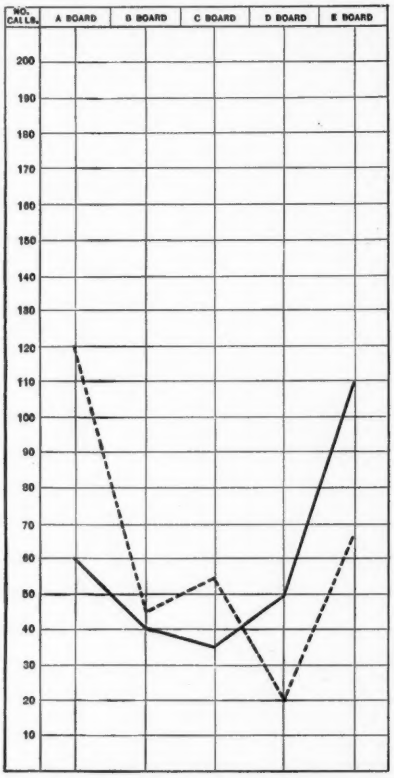
In one of our central energy exchanges of something over 1,000 subscribers I find the average cost of all current for operating line signals, supervisory signals and all current used for talking, amounts to, approximately, $6.50 per month, which is about one-fourth of the cost for current for operating the same size system with local batteries, to say nothing of the additional cost of labor for renewal and maintenance.

From a number of monthly reports of trouble, covering both common battery and magneto type exchanges, I find that the number of cases of trouble at the subscriber's instrument is from two to four times as great for local battery plants as it is for common battery plants. With one of the latest types of central energy telephones the trouble at the subscriber's station is reduced to a minimum. There is practically nothing left but the transmitter, receiver and signal bells, and these, as they are made to-day by some of our best manufacturers, almost eliminate the possibility of trouble. This, coupled with accurate and scientifically constructed apparatus at the central office, gives the ideal system. It is often remarked that it requires better line construction for common battery plants, which is true to a certain extent, but any good line will work well with common battery and in some cases this system is worked on a common return.

Telephone men are beginning to realize the importance of good line construction, especially when they see the great difference in the expense of maintenance between well and poorly constructed lines. The Bell Telephone Company's plant in St. Louis, in whose employ the writer spent several months in different departments during the building of the new common battery exchange, offers a good example of first-class construction. In building this exchange the company was extremely particular that every detail should be carried out in the best possible manner.

It seemed at the time that it was a waste of money, but I have since realized that it was money well invested. The entire system was put in so that it would stand the test of time. The interior wiring was protected in every possible way; telephones were placed on the wall in the most substantial manner; cable work and line construction was unequaled. As a result, the number of cases of trouble per telephone is less than that of any other exchange in the country. The American Bell company of Boston, has awarded it the credit of giving better service than that given by any other licensee company; and in the face of the strongest competition, I understand its financial showing is very good, which would not be possible with slighted details and poor construction.

The telephone business stands to-day on a higher plane than ever before. The Independent movement has forced the Bell companies to put forth their best efforts, and this in turn has stimulated the Independent companies; but telephony is yet far from its ideal goal. Look through the operating rooms of some of the large Bell



COMPARATIVE CURVES SHOWING WORK OF TWO OPERATORS AT THE SAME SWITCHBOARD.

and Independent companies and notice the number of idle operators, while on the same boards there are operators that have more calls than they can properly handle. Few telephone men seem to have realized the importance of equalizing the load among the operators; that is, placing enough lines in front of each operator to properly load each position. The accompanying charts, giving the peg-count curves will convey the meaning more readily and show where thousands of dollars can be saved in the cost of operating, by reducing the force, besides giving more efficient service.

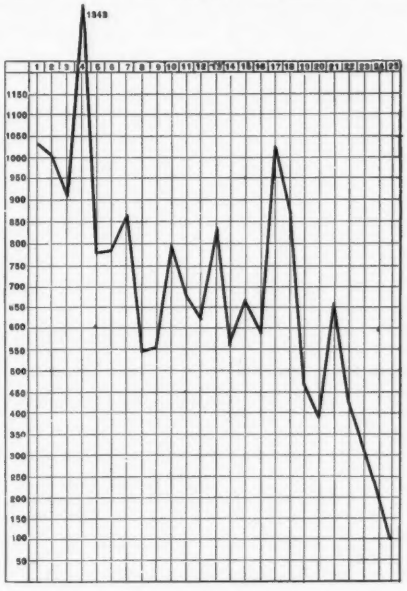
The operating force of a large exchange is one of it most important factors. If the operators are well-disciplined and courteous, the subscribers are quick to notice and show their appreciation. Even a second or two is noticeable to a subscriber when awaiting an answer from central, and on hearing the operator call "number" in a brisk, clear tone, with a rising inflection it conveys the idea of discipline; but if the operator answers with a falling inflection and uncertain voice, it gives the opposite impression. In fact, the operating force is nearer to the telephone public and wields a greater influence among the telephone users than any other class of individuals connected with the company. It is through the operators that we dispense the little courtesies that make our service popular. A few weeks ago I was examining an independent telephone exchange which was exceptional, inasmuch as it had once over 100 subscribers, but through carelessness and neglect of the manager, who lived in another town, in maintaining the telephones and outside construction, the subscription list had been reduced to 25; and those 25, I am told, remained on account of the courteous treatment they received from the operator, who was exceedingly kind and obliging to the subscribers. On the same day that I visited this exchange I was in another small city, and while talking over the telephone situation with one of the citizens there he assured me that the chief operator of the Bell company at that place had done more than any other twenty causes combined to make the Bell company unpopular. These two cases just cited certainly show the importance of courteous operators. I remember an instance where I reprimanded an operator who had formerly been with the Bell company for speaking crossly to a subscriber, her answer was, "Why, Mr. Stanton, you ought to hear how cross the Bell operators are, and you would not think we were cross!"

I prefer not to employ Bell operators. As a general thing they have some undesirable traits which become more prominent when they try to show their importance to the "new company," as they term it. There is always an army of applicants besieging a telephone company for employment, and if you are any judge of human nature you will not be long in choosing a list of girls who, with proper training and appreciation of their efforts, will make a very efficient corps of operators. There are few managers who realize the great advantage derived from the proper training of their operators. As a general thing an operator after being employed is given a seat at the switchboard beside one of the old operators and is told to watch the other operators and learn what she can, and in a short time she commences to an-

swer a few calls. From that time on she is supposed to be an operator. As a matter of fact she is far from being one. She should become thoroughly familiar with all the rules and should have their meaning explained to her. She should be taught how to handle the plugs with the left hand as well as the right. Until she can use her left hand as easily and naturally as her right she is only half an operator. She should be taught how to answer two and three calls as the same time without interference. It is only in this way that an operator can answer quickly and handle the number of calls that she should. Walk through almost any operating room, especially that of an Independent exchange, and notice the number of wooden arms and mallets that are in use; notice the number of false moves and untrained voices—and you will realize that the company is spending unnecessary money. By wooden arms I mean that the operators do not use the left arm any more than if it was wooden; by mallets, I mean that they are driving the plugs in by the heel of the hand, breaking the tinsel of the cords, causing a cut-out, which means unsatisfactory service, besides the expense of replacing the broken cords. By false motions I mean that the plug is picked up with one hand and passed to the other instead of being inserted with the hand with which it was picked up. These are only a few of the points in which operators should be trained.

The operating room should be conducted on a merit basis and promotions made according to the efficiency and courtesy of the operators. During each month competitive tests should be made to determine the speed and courtesy of operators in answering subscribers, and those having the highest general average as regards speed in responding to calls, courteous treatment of subscribers, obedience to rules, promptness in reporting for duty and regularity of attendance, etc., should receive some sort of promotion. Those who, through these tests, prove to be unqualified for the position of operator should be discharged. A form of promotion which I have found to work well is to give the operator having the highest general average the most desirable hours, and those least efficient the night hours. Another reward of merit which works well is to recognize an operator's ability by giving her a small raise in wages. I do not believe in giving an operator a large raise in wages at one time, but to encourage them and to show that their efforts are appreciated by giving them an increase of, say, $1 at a time. This may seem like a small amount, but a girl will appreciate this raise as much as a man would an increase of $5 or $10, and by giving a small raise at each time you can reward their efforts more frequently, and thus get better results. Another method which I find works admirably is to arrange each operator's merit standing, showing which is first, second, third, and so on, and leaving a copy in their recreation room. This starts a friendly rivalry among the operators which produces results that can not fail to make our service popular.

Every large operating room should be presided over by a high-class telephone man who is thoroughly acquainted with every detail of the business and who realizes the necessity of prompt action in the trouble department and the proper disciplining of the operating force. Last, but not least, he should have the faculty of dealing with the telephone public. There is no other business that requires such an endless amount of detail and everlasting vigilance. You are serving a criticising, fault-finding public, who have all the whims and fancies imaginable, but who appreciate and are willing to pay for first-class service; and your success is measured by the class of service you give.



A Peg Count Curve.

Aluminum Lines in Italy.

Three aluminum electric transmission lines have recently been installed in Italy near Naples. The lines transmit power at 3,000 volts from three horse-power turbines to the valley of Pomeii, to Sarno, and to Torre Annunziata. The lengths of these lines are two miles, nine miles, and two miles, respectively.

U. S. Government's Wireless Telegraph Experiments.

The investigations along the line of wireless telegraphy, as conducted by the United States Department of Agriculture, are approaching a crisis. Secretary of Agriculture Wilson is quoted as having said:

"The crucial test will be made in a very few weeks now. Professor Fessenden, who is acting for the department in this matter, has made some truly wonderful improvements along this line recently. What he has learned is not the result of chance, but of evolution. His methods are being kept secret, because the government has not the right to patent any discovery, and has previously been robbed of the results of its investigations by those who have stepped in quickly and secured patents. He will soon obtain patents in his own name, and in these the government will be protected.

"He is pursuing different lines from Marconi or any of the others, and his theories differ from all others thus far advanced. We can send wireless messages already over 50 miles of broken country, and there is reason to believe that this will suffice for 150 miles over water.

"The crucial test, of which I have spoken, will be made off the Atlantic coast. We will invite officers of the navy, and, if Professor Fessenden has no objection, I will throw it open to the public in general. The Department of Agriculture alone is concerned in this, but, if successful, every branch of the government will enjoy the benefit."

Bicycle and Automobile Exposition in Leipzig.

The fourth German exposition of bicycles and automobiles will be held at the Crystal Palace at Leipzig in October of this year. United States automobile and bicycle builders should not neglect this opportunity to display their goods, says the United States Consul in that city. "I believe there is little to be gained in the ordinary bicycle line, but machines driven by gas, electricity, etc., have a good future in this market. As a rule, the French manufacturers take little notice of such exhibitions, but in this instance the French consuls in Germany are using every means in their power to bring the fact home to the French manufacturers of automobiles that they will lose a splendid opportunity if they neglect to display their machines at Leipzig in October. They claim that the time is at hand to exhibit here good, well-built automobiles."

The Northwestern Electrical Association's Convention.

The Summer Meeting at Sheboygan, Wis., June 26 and 27, 1901—Papers and Discussions—Entertainments.

THE NORTHWESTERN Electrical Association's summer convention was held this year at Sheboygan, Wis., a good attendance and the usual highly enjoyable features marking the meeting, which was otherwise noteworthy on account of the excellence of the papers presented. Below will be found a complete report of the sessions of the convention:

WEDNESDAY, JUNE 26.

The convention was called to order promptly at 10 A. M. by President Debell. Instead of extending any formal welcome to all of the members, he wished they would take it for granted that they were all welcome and hoped they would have as good a time as possible. On motion, the reading of the minutes of the last session was dispensed with and they were approved as printed.

After the reception of a number of new members, the report of the Special Committee on Gasoline Lighting was read. In part, this highly interesting report, which was submitted by Mr. L. B. Livermore, chairman, was as follows:

The Committee on Gasoline Lighting must offer an apology to the convention for presenting an incomplete report, but the delay in answering our list of questions on the part of one-half of the stations in the territory covered is responsible for the greater part of it. We covered the states of Michigan, Wisconsin, Iowa, Minnesota, North Dakota and South Dakota by sending out the following list of questions to every plant in these states:

1. How many customers have you lost by reason of gasoline lamps?
2. What kind of gasoline lamp is most used in your city?
3. How many street lamps use gasoline?
4. Have lamps caused any accidents?
5. What kind of customers use most gasoline lamps?
6. Do you consider their competition serious?
7. Do your local insurance people make any objection to them?

Out of 370 inquiries sent out only 160 replies had been received in time to figure up the report. The results are as follows:

The number of plants reporting customers lost is 75, running from two or three each up to 50. Many report that customers come back after trying gasoline, so the net loss of actual customers in the district covered is remarkably small.

2. As to kind of lamps: Reports show all kinds, some towns having eight to ten different kinds of gasoline lamps. The most common are the hanging lamps, gravity burning, and the air-pressure lamps, tanks or generators in basements.

3. Street lamps: Only five cities report use of gasoline street lamps:

Minneapolis, Minn., 1,500; St. Paul, Minn., 3,000; Dubuque, Iowa, 100; Des Moines, Iowa, 100; Winona, Minn., 70.

They do not seem to be used at all in the small towns and cities for street lighting, according to our reports. Dubuque reports just discarding the last 100 gasoline street lights.

4. Accidents: There is hardly a report that does not mention one or more accidents resulting from leaks or explosions of gasoline lamps. A pamphlet published by the Illuminating Publishing Company, of Cincinnati, Ohio, entitled "Is the Use of Gasoline and Acetylene Dangerous to Human Life," has just been published and contains a ghastly record of lives lost, terrible injuries and great loss of property. The committee advises each manager or superintendent to buy a few copies of this pamphlet and send one to each gasoline user in town. If he continues to use the dangerous fluid after reading that work he is beyond salvation.

5. What class of customers use most gasoline lamps?: The users of the lamps seem to be mostly small merchants, barbers and grocers, saloons, restaurants and drug stores and from the reports we gather that many of these people are rather undesirable customers and are always looking for something for nothing. However, there seems to be a class of long-hour burners, such as saloons, drug stores and restaurants, who keep open late at night, and on the usual method of charging no doubt feel that they must economize. Then they listen to the gasoline man, and he has what they want—cheap light. It would seem to the committee that a proper discount to long-hour users would retain many of these who look to gasoline to keep down expenses. The larger stores usually put in pressure-tank plants and, from the reports, they are very short lived, caused by poor regulation, heavy cost of mantles and glassware.

6. Do you consider their competition serious?: The cities of Oelwein, Iowa; Lead, S. D.; Marengo, Iowa; Corning, Iowa; Owatonno, Minn.; Creston, Iowa; What Cheer, Iowa; Spencer, Iowa; Tipton, Iowa; Tecumseh, Mich.; Montevideo, Minn.; St. Paul, Minn.; Monroe, Wis., all report that the competition is serious. The balance, or 90 per cent of the towns heard from, do not consider the competition serious. They think that the people that use them do not get satisfaction, and that they are not a success. A certain percentage of people are always trying new things, and, of course, there will always be many lamps and machines that will perhaps look as though they would give the electric and gas plants a run for their money, but the general result seems to be that where good service in gas or electricity is to be had at reasonable prices, the gasoline lamp will only be used by the few kickers and cheap people that we all come in contact with. In no case does the report indicate that this competition caused a lowering of rates. Many places report that nearly all their customers who experimented with gasoline have given it up, or, where they have made a large investment in a plant, keep it and use electricity also.

7. Do the local insurance people make any objection?: A very few places report that the insurance rates are raised on people using gasoline lamps. Most of the reports would indicate that there is no objection at all. The proper excess charge is 25 per cent of usual premiums, but the competition among the insurance companies is so fierce that only in rare cases do they make any raise in the rates. If one agent does, another stands ready to take his risks at the old rate. The opinion of the committee is that they being recognized as very unsafe and dangerous and should be rigidly prohibited, not because of the competition they give us in some cases, but because they are unsafe, dangerous to an extreme and a source of danger to the people on each side of them or above them who do not use them.

In conclusion, it would seem from these reports that each town has lost from a few

to a large number of customers by reason of gasoline competition, but that most of these people have returned to the use of electricity, showing that while gasoline may be a very cheap light there must be great drawbacks to its general use. There are, in every town, lots of people looking for something for nothing, and the gasoline idea is a smooth one and catches their fancy. They do not know the origin of the fluid, its quick evaporation on exposure to the air and its consequent danger; and it is only by actual experiment that they become convinced that it is no good, and usually after paying $150 or more for an outfit that cost about $25. Of course, it won't do to lose sight of this fact—that where many minds and much money are concentrated on one object it is more than likely that some day a perfect gasoline lamp will be invented, and we must be on our guard and hold our customers by giving good service and good rates. But at present it is evident that it does not seriously threaten our interests.

Professor B. V. Swenson then read the interesting paper on technical training, which is fully abstracted elsewhere in this issue of the ELECTRICAL REVIEW. After several communications from absentees and invitations were read, there being no further business before the session, the convention adjourned until the next day.

THURSDAY, JUNE 27.

The second session was called to order promptly at 10 A. M. by President Debell. A communication from the Milwaukee, Wis., Industrial Exposition was then read, inviting the association to be present.

Professor Dugald C. Jackson was elected an honorary member of the association.

Mr. Budd Frankenfield then read his paper, entitled "The Efficiency Curve of a Shunt Motor and Its Relation to Operating Characteristics and the Cost of Operation."

This paper concluded the programme for the morning session. The afternoon was devoted to amusements, a trap-shooting contest on the Gun Club's grounds, games, etc., and a theatrical performance in the evening. Several members having been elected, the convention adjourned, *sine die*.

According to an Italian journal, in a large hat factory in Italy an electrolytic process is used in water-proofing linen and chamois skin. The process is secret.

TRADES TRAINING FOR NON-TECHNICALLY EDUCATED MEN.*

BY B. V. SWENSON.

The state university is under obligations to the commonwealth which are not felt by educational institutions of independent endowment; created by the state, supported by the people of the state, its advantages and influences should be made as far-reaching as possible.

As an example of the dissemination of trades knowledge among the people of the state may be cited the work now being carried on in agriculture and its allied industries. For a number of years short courses in agriculture, animal husbandry, dairying, etc., have been given to practically all those who have had the ambition to acquire such knowledge. During the past 15 years there has been an ever-increasing demand from those engaged in other industrial pursuits for trades training applicable to their special needs. To meet this demand there has been established, at the University of Wisconsin, a School for Apprentices and Artisans, which opens July 1, the first session to continue six weeks. The plan of this school, which originated with Dean J. B. Johnson, has been worked out and will be carried on under the direction of the College of Engineering.

That there is a great need for training of this character is clearly shown by the large enrolment of the correspondence schools. These schools have exerted a powerful influence in assisting men to study along their own and other lines of work.

The School of Apprentices and Artisans, while bearing in its courses of study some relation to those of the correspondence schools, is not in opposition, but should rather be considered as supplementary, to the latter. From the nature of their instruction, the correspondence schools can not give shop or laboratory practice, but persons attending the school for apprentices and artisans, and having a fair knowledge of certain lines of practice, may spend their entire time in the shops or laboratories if they choose, and so put into practice or prove experimentally the scientific principles learned from books or from the correspondence school. Another great advantage of the new school is that of personal instruction, under which system many points can be brought up in discussion which would not appear in written correspondence.

As an illustration, the central station man who, by means of correspondence instruction or otherwise, has become familiar with methods of testing could here perform the experiments relating to them and become proficient in the use of the necessary instruments. If he has not had the preliminary instruction he can obtain both this and the instrumental practice during his course, and he would also have the opportunity of devoting a portion of his time to other subjects likely to be of value to him, such as mechanical drawing, transmission of power or experimental work relating to engines and boilers.

The School of Apprentices and Artisans has been established for the benefit of machinists, carpenters, sheet metal workers and electricians; stationary, marine and locomotive engine men; shop foremen and superintendents; superintendents of waterworks, electric light and gas plants, power stations, factories and large office and store buildings; for business men interested in technical affairs, and for young men who wish to qualify themselves for such positions. For these employments the full four years' professional courses in engineering are not required, and yet to satisfy the present demand on this class of men it is necessary for them to obtain a certain amount of technical knowledge. In the case of apprentices the purpose of the school is to give them a theoretical and practical instruction in the line of their trade, which they would not get in the shops, but it is not the purpose of the school to give the shop practice which they are expected to receive in serving their apprenticeship.

The machine trades lie at the basis of all manufacturing, and superiority in these very largely sustains our modern prosperity. The practical abandonment of the apprenticeship system, also, as a result of the very general adoption of labor-saving machinery and the common practice of confining a workman to the operation of a single type of machine, leaves our young men with no means of acquiring that wide and thorough knowledge of the machinist's trade which formerly they could obtain in the workshops by a long apprenticeship. For these reasons some new kind of industrial education becomes imperative. Some examples may serve to illustrate the advantages to be derived in special cases.

This project has received favorable comment from the press, the technical papers and from prominent educators and business men throughout the country. If there is a sufficient demand for technical training of this character it is proposed that schools will be established in the manu-

* Abstract of a paper read before the Northwestern Electrical Association, June 27, 1901.

facturing centres of the State of Wisconsin in which instruction of the character described be given exclusively, in short terms, throughout the year.

I might say in conclusion that this project was started along in the winter and we sent out a number of bulletins, and we will probably have somewhere between 50 and 75 students this year, and as regards the classes of men you can say that we hope to be able to be a practical benefit to the electrician as well as machinist and people of that class.

The Wonderful Electric Lighting at the Pan-American Exposition.

[From the Mail and Express, New York.]

If I could see the exposition for but a single hour, I should choose to have that single hour at night. For if everything else about the Pan-American should be forgotten, it will be remembered for its matchless illumination.

To feel the full charm of the Pan-American night you should see both the sunset and the electric dawn which follows. Twilight hushes the sounds of road-making, of programme-selling and even the husky voices of the Midway "barkers." The light —dazzling at midday in these asphalted courts—sinks to a subdued glow. As eight o'clock nears, people begin silently to gather on the Triumphal Bridge, turning expectant eyes upon the Howard Electric Tower. But long after the sunset glow has faded there is still no sign of light.

Then, when your attention has wandered, a sudden glint of fire arrests your eyes. Some electric bulb on the bridge pylons has begun to glow. Now look back to the tower. It is flushed from base to tip with faint rose fire. And now the band plays soft melodies as the light grows slowly brighter on every dome and pinnacle, in every window-arch and cornice, in every bulb cluster on carven light-post, until the soft twilight is turned to glorified day.

The tinted walls seem half dissolved in light. Not lustreless staff, but onyx or clear alabaster they seem; translucent, drinking in the glow. But the tower! There is no simile for that, simply because the world never saw before anything so transcendently bright and yet so undazzlingly soft. It looks not like a lighted tower, but a tower of light. Nowhere is it so beautiful as from the rim of the pool at its foot, or from the plaza court.

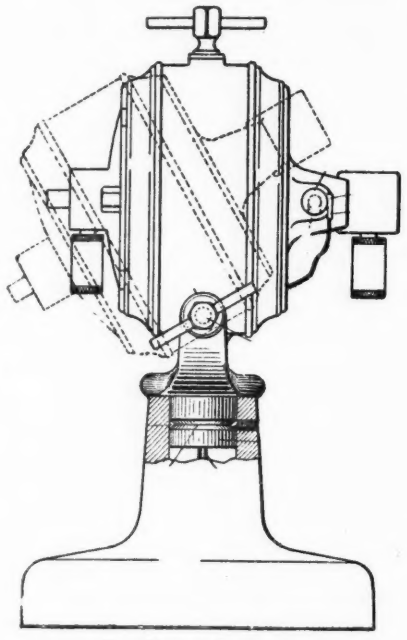
Go back now into the promenade of the propylæa, its columns turned to shafts of precious stone, and let your eyes have their way. When you have absorbed all that you can on shore you must see the illumination from the water.

This is no time for economy. Step into one of these slender-pointed gondolas and slip through the glowing waterways to the tune of the boatman's song, under bridges rimmed with fire, to the basin of Mirror Lake, where fire-crowned dome and glowing tower burn in the bright depths of the pool. From far away come faint echoes of sweet music; "soft stillness, and the night, become the touches of sweet harmony."

MARY BRONSON HARTT.

Electrical Patents

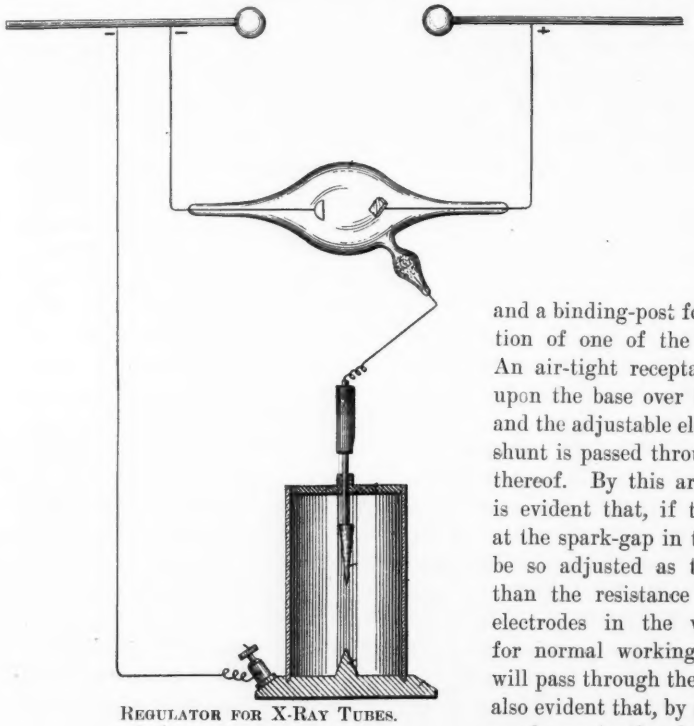
Another adjustable fan motor support embodying a novel construction has been originated by Mr. Fred P. McBerty, of



FAN MOTOR SUPPORT.

Warren, Ohio. A base is provided having an upstanding hollow standard and the hollow stud of a yoke is rotatably mounted in the upper end of the standard. This stud has an annular groove, the ends of which are spaced a slight distance apart to form a stop, and a set screw carried by the standard engages in this groove. By this means it is evident that the yoke can be rotated upon the base, but that this movement is limited by the set screw engaging the stop, and that there is no danger of the conducting wires becoming twisted off or short-circuited. The motor casing is supported between the yoke by means of pivot bolts, so that it has a vertical tilting movement. The result of this construction is that a universal adjustment may be given the fan, as it can be rotated in a horizontal direction and tilted vertically to any angle desired.

In order to regulate the vacuum in Crookes tubes, such as are used for the generation of Rœntgen rays, Mr. Harry F. Waite has devised and patented a novel construction employing a volatile salt, arranged in communication with the tube and connected with a shunt current. In practice, he uses a vacuum bulb having a small auxiliary tube communicating therewith. The usual terminals of the poles are located in the tube and connected with the generator. The volatile salt, which may be hydrate of potash or other suitable gas-producing agent, is placed in the auxiliary tube and a shunt circuit is connected therewith through an adjustable spark-gap to the negative pole. The spark-gap consists of a base of conducting material having an electrode projecting therefrom,



REGULATOR FOR X-RAY TUBES.

and a binding-post for the connection of one of the shunt wires. An air-tight receptacle is placed upon the base over the electrode, and the adjustable electrode of the shunt is passed through the cover thereof. By this arrangement it is evident that, if the resistance at the spark-gap in the receptacle be so adjusted as to be greater than the resistance between the electrodes in the vacuum bulb for normal working, no current will pass through the shunt. It is also evident that, by adjusting the spark-gap in the shunt, the current will pass therethrough, and the salt volatilized at will to regulate the vacuum in the bulb.

Tanning by Electricity.

Tanning, by the time-honored method of steeping the hides, is perhaps the longest of industrial processes. The great length of time taken up in the conversion of skin into leather, legally enforced in the days of our fathers, has tempted inventors to try more expeditious methods. One of the most successful results of this search was the substitution of chrome for tannin, an innovation which set the leather-dyers a hard puzzle to solve. But it is a commercial necessity that tannin should still be used, and it was quickly found that an electrolytic process of hastening the work was feasible. Since first attempts great improvements have been made. A just-published work, Blount's "Practical Electrochemistry," gives a good account of the latest processes, and we give a résumé of this, with some comments which suggest themselves.

The slowness of the process of tanning is largely due to the difficulty with which the tannin penetrates into the hide. As the penetration progresses, the outer part of the hide becomes converted into leather and is thereby made impervious, consequently the rate of penetration decreases. Months of soaking in the tanpit are therefore necessary for thick hides. Many attempts have been made to hasten this absorption of tannin by hide. The methods used include circulating the tan liquor so that fresh portions are continually presented to the hide, forcing the liquid through the hide by pressure and using strong aqueous extracts of tanning materials. It has been sought to attain the same object by passing a current of electricity through the vat in which the hides are suspended. One such process (Groth's) has been found to shorten the time of tanning to a quarter of that necessary when no current is used, and the leather is said to be unexceptionable. The apparatus devised by Groth is designed to hasten tanning by circulation of the tan liquor, as well as by the use of electricity.. The tan liquor is contained in a tank in which is a frame carrying hides, and capable of being moved to and fro or rotated so as to bring the hide continuously into contact with fresh liquor. Copper electrodes are placed at the side of the tank. For a vat holding 1,500 gallons a current of not more than four amperes is used.

The current density is not more than one-tenth ampere per square foot of transverse section of the vat. With this mild stimulus it was found that the rate of tanning was 16 times as fast as when the hides were simply immersed in the tan liquor and allowed to be stationary, and four times as fast as when the hides were moved and no current passed. Considering the well-authenticated test which has been made, it is noteworthy that tanners at large will have nothing to say to electric tanning. In the Worms and Bale process (which was the forerunner of Groth's) the apparatus used is a barrel of about 12,000 litres capacity and taking a charge of 700 kilometres of hide and 5,000 litres of oak-bark extract. The electrodes attached to the inside of the drum are of copper. A current of 11.5 amperes at a pressure of 74 volts is used. Tanning is said to be complete in 48 to 144 hours, but the process is somewhat violent, the leather suffering from the mechanical pounding which it receives.

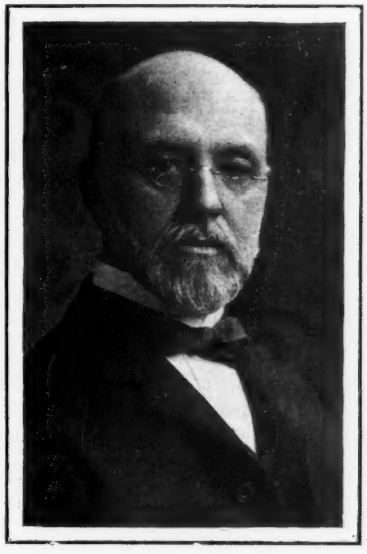
It would appear that the chief improvements that have been made in tanning by electricity are in economy of current in the first place and secondly, in adopting a method for bringing the hides into contact continually with fresh portions of the tanning liquor, whereby they are not brought into collision with solid matter, such as the sides of the drum, and are consequently preserved from damage.—*The Electrochemist and Metallurgist.*

The Visiting Committee of the National Bureau of Standards.

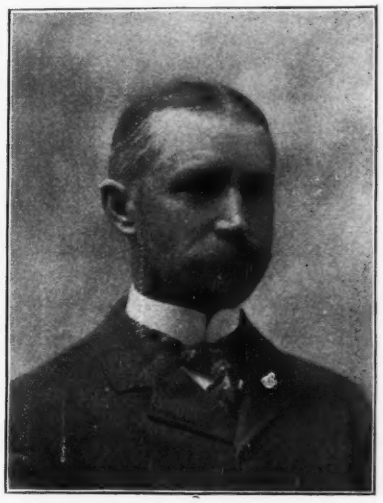
The Visiting Committee of the National Bureau of Standards, at Washington, D. C., has just been appointed. The following gentlemen comprise its membership: Professor Elihu Thomson, Lynn, Mass.; Professor E. L. Nichols, Ithaca, N. Y.; Professor Ira Remsen, Baltimore, Md.; Dr. Henry S. Pritchett, Boston, Mass., and Mr. Albert Ladd Colby, South Bethlehem, Pa.

Professor Elihu Thomson is too well known to the electrical field to require any introduction here. Professor Edward L. Nichols is professor of physics and in charge of the Department of Electrical Engineering at Cornell University, and is well and widely known by reason of his many writings and the original research which he has conducted for many years. Dr. Remsen was, until lately, professor of chemistry in the Johns Hopkins University, and has recently been appointed to the presidency of that institution. Dr. Pritchett is the president of the Massachusetts Institute of Technology, Boston, and was formerly connected with the United States Coast Survey, where his brilliant work attracted much attention. Mr. Colby is a metallurgical engineer, the secretary of the Association of American Steel Manufacturers, and is an officer of the Bethlehem Steel Company of Pennsylvania

The list of names is as good as could have been selected, and it is certain that under the supervision of these eminent scientists and engineers the National Bureau of Standards can not fail to exert the high and valuable influence which is believed to be its destiny. The eminently practical character of the committee is a cause for congratulation, and the inclusion in its membership of two gentlemen prominently identified with the electrical arts will insure the proper consideration of the exceedingly important matter of electrical standards.



PROF. IRA REMSEN.



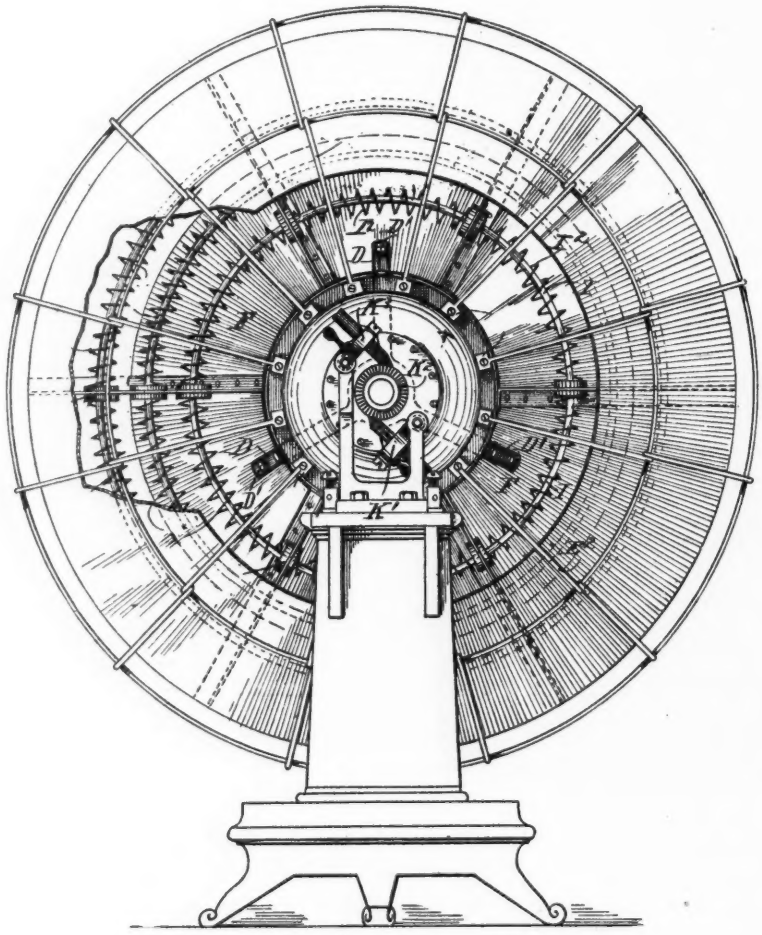
DR. HENRY S. PRITCHETT

PROF. ELIHU THOMSON

PORTRAITS OF THREE OF THE VISITING COMMITTEE OF THE NATIONAL BUREAU OF STANDARDS.

A Novel Electric Heater.

Mr. Gardner C. Hawkins, of Boston, Mass., has originated and patented two rather novel ideas in the line of heaters, which he has assigned to the Bay State Electric Heat and Light Company, of Jersey City, N. J. The object of the inventor is to provide means whereby the heat will be thrown horizontally into the room, and thus be more evenly diffused, instead of rising immediately to the ceiling as with ordinary radiators. In one device he provides an electric fan, the motor of which is constructed and supported somewhat on the order of the well-known buzz fan, the blades, however, being located between a pair of cones that are spaced apart and secured to the shaft so as to rotate therewith. Between these cones are placed heating coils, having electrical connection with the same source of power that drives the motor. By this construction it will be seen that when the fan is revolved, the air will be drawn through the cone, thus coming into contact with the heater coil, and will be driven horizontally into apartment to be heated. The inventor also claims that the rapidly moving current of air passing through the fan increases the life of the heating resistances or conductors, owing to the rapid removal of the heated air from the surface of the same. In the other patent, he provides a small steam or hot-water radiator pivotally mounted upon a vertical supply pipe, and supports a fan behind this radiator by means of a bracket also pivoted to the supply pipe, said fan having a pivotal connection with the outer end of the bracket. The fan can therefore be located at any desired distance from the radiator, or at any angle thereto, so that, to obtain the maximum heating effect, the radiator and fan are moved towards each other, and when less heat is desired, the fan is arranged at an angle to the heating surface.



Novel Electric Heater—Sectional View.

The total production of copper for the year 1900 was 486,084 tons as against 472,244 tons produced in 1899. Of this amount the United States produced 55 per cent.

Electrolytic Copper Bars.

A British patent has been granted for a process for making copper bars by electrolysis upon the surface of a cylinder of cast iron, which is the cathode and which is arranged to rotate. In the bath a spiral of insulating material is applied. The deposit of copper forms in a bar or band between the spires of this and may subsequently be unrolled and straightened out.

Interference with Wireless Messages.

On June 25 the steamer Kaiser Wilhelm der Grosse attempted to continue communication with the steamship Lucania after the former had left her pier in the North River, but it was found that after proceeding two or three miles messages could not be exchanged. It is thought by some of those interested in the tests that the steel structures of the high buildings in New York which intervened between the two ships possibly had something to do with the negative result.

Death of Albert L. Johnson.

Mr. Albert L. Johnson, the street railroad builder and promoter and brother of Mayor Tom Johnson, of Cleveland, Ohio, died Tuesday night at his home on the Shore Road, Fort Hamilton, Long Island. He had been suffering for three weeks from heart disease and the extreme heat presumably caused his death.

His mother, his brother Tom and his four children and two physicians were with him when he died.

Mr. Johnson was born in Kentucky about 40 years ago and has been prominent in street railway circles for many years.

New Long-Distance Telephone Rates.

The American Telephone and Telegraph Company has announced the adoption of a three-minute schedule of long-distance telephone rates uniformly throughout its system of lines, which took effect July 1. The three-minute schedule has been in operation between points west of Pennsylvania and in the South for more than a year, and it has now been made to apply throughout the eastern states where the initial rate for five minutes has been in force.

This makes a reduction generally of about 40 per cent in the initial rate, the overtime charges running *pro rata*.

Where the initial rate between New York and Philadelphia has been $1, the new three-minute rate is 60 cents, and corresponding changes have been made in the rates between all other points in the East.

It is understood that the lines and facilities of the company have been largely increased to provide for the reduction.

Current Electrical News

Commercial News

EXPORT AND DOMESTIC

A German firm has secured the contract for the electric lighting of the city of Pekin.

The recent rainstorm in Pittsburgh, Pa., did considerable damage to the works of the Westinghouse Electric and Manufacturing Company, at East Pittsburgh. The damage was estimated variously from $50,000 to $200,000.

The Toledo Traction Company, which comprises all the street railways of Toledo and operates the electric lighting plant there, has been sold to the Everett-Moore Syndicate, of Cleveland, which also owns the Cleveland Electric Railway, the Detroit United Railway and suburban electric lines operating out of Cleveland, Toledo and Detroit.

The American Iron and Steel Association has ascertained from the manufacturers that the production of iron and steel wire rods in the United States in 1900 amounted to 846,291 gross tons, against 1,036,398 tons in 1899, and 1,071,683 tons in 1898, showing a decrease of 190,107 tons, or over 18 per cent in 1900 as compared with 1899. Of the total production in 1900, 1,929 tons were iron rods, and 844,362 tons were steel.

Kuhn, Loeb & Company and the Mercantile Trust Company, of New York, are making arrangements to announce the building of the North River Bridge connecting New Jersey with the city of New York. The chief patron and endorser of the bridge will be the Pennsylvania Railroad Company, but it is to be presumed that all the railroads entering Jersey City and Hoboken will be privileged to use the bridge to enter New York city. A syndicate to raise $30,000,000 to inaugurate the work is being formed, and it is hoped to begin the work of construction this fall.

There is wonderful activity in the electric railway field in all parts of the United States. There is an evident demand for long-distance service and the connecting up and consolidating of city lines with suburban lines connecting cities and towns is in strong popular favor. A number of the most active and influential of the financiers of the country are interested in this development and the demand for electrical machinery and apparatus, which is caused by this vast expansion of the electric railway, is one of the things that is crowding with orders the electrical industry in almost every manufacturing branch.

It is announced from London that the United States Steel Corporation has begun to underbid the English steel manufacturers. Staffordshire consumers are said to be receiving honors from London brokers on behalf of the steel corporation of Bessemer billets in 1,000 and 2,000-ton lots at £5 per ton delivered in England. This means less than $24.50 per ton delivered in the heart of the British manufacturing district. The present quotations in Great Britain are from $24 to $25 per ton at Pittsburgh, and the ruling English price for billets is more than $25 per ton, so that the steel company's present figure is about two and one-half per cent under that of the British manufacturers.

The report is again revived that the Western Union Telegraph Company and the Postal Telegraph Cable Company will unite. The latest version is that negotiations have been proceeding in Europe, where Mr. John W. Mackay, president of the Commercial Cable Company, is at the present time. It is predicted that the consolidation will occur within the next two months. The Western Union Telegraph Company has been in existence for 50 years, and in that period has absorbed many competitors by purchase or lease, until its business has grown to vast proportions. In 1899-1900 it operated 933,153 miles of wire and handled 63,167,783 messages. The present capital stock outstanding is $97,370,000 on which a five per cent dividend was paid in 1900. The Postal Telegraph, which was capitalized at $15,000,000, was sold in January, 1897, to the Commercial Cable Company. It is well equipped and under energetic and wide-awake management.

Electric Lighting

The plant of the Rappahannock Electric Light and Power Company, of Fredericksburg, Va., was sold at public auction to Mrs. J. B. Ficklen.

A new electric power-house is to be erected by the city of Nashville, Tenn. An investment of about $20,000 is contemplated in building and apparatus.

The Columbus Edison Company, Columbus, Ohio, has declared the regular quarterly dividend of three per cent on the preferred stock, payable June 29.

The North Shore Electric Company, at Hoquiam, Wash., is installing an electric light plant in that city. The station will be erected on the water front.

It is expected that the electric light plant which is to be built at Belfort, N. Y., by the Carthage Electric Light Company, of Utica, N. Y., will be in operation by fall.

The new plant of the People's Electric Light Company, at York, Pa., will be in operation by the middle of October. The work of construction is proceeding vigorously.

The town of Elder, Ga., has contracted for an electric lighting plant to be installed by Mr. P. R. Highton, of Minton, Ga. It is to be in operation by September 1, 1901.

The village of Amherst, Wis., has granted a franchise to B. E. Dinswell & Company to put in an electric light system in that town. The franchise is to run for 15 years.

At an election held at Daytona, Fla., to vote on a franchise for an electric light system, the vote stood 81 in favor to 5 against. The citizens now wonder who the five were.

At St. Joseph, Mich., a contract has been let for the building of a municipal plant at a cost of $12,600, to the C. L. Olds Company, of Fort Wayne, Ind.

The contract for building the new electric light plant at the Winfield, Kan., Imbecile Asylum has been let to the Fort Wayne Electric Company for $4,250.

The village of Collinwood, near Cleveland, Ohio, is receiving proposals for an addition to the municipal lighting plant. E. P. Robertson & Company are the engineers in charge.

Steps are being taken to establish an electric light plant in Media, Pa. At present the borough is operating a limited plant, which is not sufficient for the demands made upon it.

The Electric Light Company, of Niobrata, Neb., has been sold to Messrs. Randa and Gruenberg, who will take charge immediately and enlarge and improve the plant. The consideration was $1,600.

The Coxsackie Electric Light Company and the Athens Electric Light and Power Company of New York have consolidated with the Upper Hudson Electric Company. The capital of each was $20,000.

The Sardis, Miss., Electric Light and Power Company has been organized and will soon install an electric lighting plant for the purpose of lighting the town. The cost of the plant will be about $10,000.

The American Light and Water Company, of New London, Wis., has filed an application for the purchase of the present electric light plant in that city. The proposition is to be considered by a mass meeting.

The city of Tipton, Ind., has contracted for a municipal electric lighting plant to cost $30,000 and work will begin immediately. The present contract of the city for lighting expires in October next.

The Greensboro, N. C., Electric Company has been granted a franchise to furnish arc and incandescent lights and electric power, and to build and operate an electric street railway system in Greensboro.

The Rockville, Md., council is endeavoring to arrange for the location of a new power-house to replace the one recently destroyed by fire. The cost will be about $10,000. It is proposed to borrow the money for this purpose on the notes of the citizens.

Texarkana, Tex., has granted a 30-year franchise to R. M. Shaw and other capitalists of Kansas City, to build and operate an electric light plant and street railway. It is planned to have the plant completed and in operation by the first of July next year.

Plans are being prepared for the new electric light and power plant which the recently incorporated New Jersey Light and Power Company will erect at Kearny, N. J., at about a cost of $150,000. It is stated that they expect to start active building preparations before the end of the summer.

The deal consolidating the Birmingham Railway, Light and Power Company, the Consolidated Electric Light Company, and the Birmingham Gas Company, has been arranged by Mr. H. M. Atkinson, of Atlanta, and the Old Colony Trust Company, of Boston. The new corporation will have a capitalization of $10,000,000.

The Gainsville Electric Light and Power Company, of Gainsville, Ga., has been organized with a capital of $100,000. It is proposed to develop the water power on the Chattahooche River. Lights for the city of Gainsville will be supplied and later on the company will take up the question of a street railway system. Among the incorporators are F. L. Murray, of Chicago; J. J. Spalding, of Atlanta; J. J. Dunlap, Z. T. Castleberry, H. H. Dean, M. M. Ham, E. E. Kimbrough and Howard Thompson, of Gainsville.

The town highway commissioners of Southold town, L. I., are considering the application of Mr. J. Henry Perkins, of Riverhead, L. I., for a permit to erect poles and string wires for electric lighting, power and heat. It is the intention of the promoters to furnish electric lights for Quogue and Westhampton, Jamesport, Mattituck, and one or two other places on Long Island. If the permit is granted, Mr. Perkins agrees to furnish electric lights for commercial purposes at not more than one cent per lamp per hour; street lights, 25-candle power, at not more than $20 per annum each, and to allow the town authorities to place wires on the poles for fire-alarm purposes.

Electrical Securities

The whole of the general business situation remains as favorable as ever and prosperity is reported from all quarters. Railroad earnings have been good, the crop outlooks are excellent, and the weather through the month for growing grains has been excellent. While these facts tend to maintain the high position of investment values, the speculative market has been a little shaken by recent difficulties. The failure of a New York national bank and a large speculative house, together with the rumors that have been circulated regarding it, are naturally adverse factors in the situation. This, taken in connection with the state of the money market, has operated somewhat to prevent higher quotations on certain securities at this time. Large disbursements will be made early in July and it is expected that money will be plenty after this date. As a matter of fact, the whole market may be said to be in the condition of flood tide at the present, and even the wisest speculators are unable to hazard an opinion as to the general trend of prices for the next two or three months. The figures given below in each case illustrate the fluctuations of electrical securities during the week ending June 29:

ELECTRICAL SECURITIES FOR WEEK ENDING JUNE 29.

New York:	Highest.	Lowest.	Closing.
B'klyn R. T.	82¾	82½	82¾
Con. Gas	223¼	222½	223½
Gen. Elec.	269	267	267
Man. El.	125⅛	125	125⅛
Met. St. Ry.	174¾	174¼	174¾
Third Ave. R. R.	122	122	122
Kings County Electric	...	...	205
N. Y. & N. J. Tel. Co.	...	...	178
Telep., Tel & Cable Co.	...	...	6

The stock of the American Telephone and Telegraph Company has passed the listing committee of the New York Stock Exchange but as the company has no New York certificates ready it is thought that it will be September before the stock can be traded in here. The authorized capital stock of the telephone company is $150,000,000, of which the amount now issued is $94,237,500, held by about 8,000 stockholders. The company may add to the list from time to time $20,709,000 additional of said stock on official notification to the Stock Exchange that the same has been paid for, issued and delivered.

New York Electric Vehicle Transportation securities were recent features of the market, advancing about two points on buying by insiders. There is much favorable prediction respecting the outlook for this company.

The upward movement in Manhattan Elevated during the week was evidently caused by a revival of the report that the company was to be leased to the Metropolitan at the rate of six per cent upon the stock. Mr. Russell Sage, one of the largest owners, however, denied the rumor.

A private Baltimore despatch says: "There is a very good demand for United Railways and Electric of Baltimore common stock. The company has a monopoly in Baltimore. No other railway can put a car in the city."

Boston, June 29:	Closing.
Am. Tel. and Tel.	156½
Erie Tel.	55
New Eng. Tel.	140
Mass. Elec. pf.	42¾
Westing. Mfg. pf	98
Edison Elec.	260

It is reported that bids of 38½ have been made privately for 5,000 shares Massachusetts Electric common stock, but refused. The stock is believed to be intrinsically cheap. This organization, which is presumably backed by Mr. J. Pierpont Morgan, now comprises one of the three great railway systems in Massachusetts. These are: the Boston Elevated, the Massachusetts Electric Company and the Worcester Consolidated. Mr. Morgan is said to own 9,999 shares of Boston Elevated, and his firm has a large stock interest in Massachusetts Electric. Closer relations between these two companies are expected.

The Boston Stock Exchange has listed 5,000 additional shares of Seattle Electric preferred.

The stockholders of the Edison Electric Illuminating Company and the Boston Electric Light Company, of Boston, have voted to consolidate, the union to continue under the name of the Edison Electric Illuminating Company. It was decided to increase the board of directors from nine to twelve.

New England Telephone rights were sold on the local board at 5½.

Philadelphia, June 29:	Closing.
Elec. Co. of A.	73⅝
Philadelphia Elec	5⅝
Union Traction	27¾
United G. I. Co.	118
Elec. S o. Bat. c.	80
Elec. Sto. Bat. pf.	80

The consolidation of the American Railways and the Electric Company of America is still being discussed. It seems now improbable that the merger will occur. It has been suggested that the Electric Company of America might be reorganized by reducing the 400,000 shares to 200,000, par $10, full paid, giving for each 100 shares of present stock a $1,000 four per cent bond. It is estimated that the earnings would be sufficient to pay the interest on the bonds and leave a surplus sufficient to pay five per cent on the stock. It is unofficially announced that Mr. Thomas Dolan will resign as director of the Electric Company of America, and that the United Gas and Improvement Company has sold out its holdings in that company.

Electric Storage Battery was again a prominent feature. The *Inquirer* for Wednesday, June 26, said: "After opening at 72, Electric Storage Battery common sold up to 76¾, and the preferred advanced to 75. The strength of these issues may have been due to indefinite rumors that there will be a consolidation of electrical interests which will embrace the Electric Storage Battery Company, but it was probably a natural recovery from the slump following the announcement of Edison's invention of a new battery. The other companies mentioned in the deal are the General Electric Company and the Westinghouse Company, two of the largest and most thrifty concerns of the kind in this country."

A private despatch from New York to one indirectly interested in Mr. Edison's storage battery states that Mr. Wm. C. Whitney has made overtures to get control.

Chicago, June 29:	Closing.
Chicago Edison Light	176
Central Union Telephone	36
Chicago Telephone	276
Un. Trac.	19½
Un. Trac. pf.	60
Metropolitan El.	92

Union Traction has been in fair demand. It was about the only issue in the transportation group that showed any life during the week.

The Chicago Railway is doing a very prosperous business. It recently ordered 120 cars from St. Louis. The new cars put into service some time ago prove very satisfactory and the additional order is for the same pattern.

Central Union Telephone stockholders are not taking kindly to the proposed assessment to put the company on an easier basis. It is hardly probable that the shareholders will accede to an assessment, and as the laws of Illinois prohibit a forced assessment, the course likely is to issue four per cent debenture bonds and perhaps go through a reorganization. The stock of the company shows particular strength in view of this condition.

Telephone and Telegraph

The Consolidated Telephone Company was chartered at Dover, June 28, with a capital of $10,000,000. The company is authorized to manufacture and deal in telephone appliances and materials and operate telephone exchanges. This company will father a number of independent companies between Boston and Chicago, and will reach the more important cities between those two points.

The Postal Telegraph and Cable Company is greatly extending its wires on the Pacific coast, particularly in the Northwest. The direct line from Denver to Salt Lake, and from there to Spokane, tapping the Utah and Idaho country not touched by the Postal lines, is nearly completed. An additional line is also being built between Portland and Spokane.

At a meeting of the directors of the New England Telephone and Telegraph Company, it was voted to issue $2,577,000 new stock. Payments are to be made one-half August 16 and one-half November 16. This issue will give rights to one share of new stock at par for every six shares now held. This company now has about 80,000 subscribers and is adding to this number at the rate of about 1,000 new subscribers per month.

The Inter-Ocean Telephone and Telegraph Company was incorporated last week with a capital stock of $2,000,000. The company will operate a telephone and telegraph system connecting the following places: Cleveland, Ohio; Westfield, Buffalo, Niagara Falls, Rochester, Oswego, Ogdensburg, Whitehall, Syracuse, Rome, Utica, Schenectady, Troy, Albany, Poughkeepsie and New York city, Newburg, Goshen, Binghamton, Cortland, Owego, Waverly, Elmira, Ithaca, Auburn, Canandaigua, Corning, Hornellsville, Geneseo, Jamestown, Salamanca and other cities and villages in New York state, and Jersey City, N. J. The directors are Charles H. Stewart, Joel H. H. Fuller, Charles B. Stowe, and Burt G. Hubbell, of Cleveland, Ohio; William T. Morris, of Penn Yan, and Harry K. Brown, of Hornellsville.

New Incorporations

TERRE HAUTE, IND.—Terre Haute, Electric Company. $1,000,000.

DOVER, DEL.—United Railway, Light and Charter Company. $5,000,000.

TRENTON, N. J.—Lancaster County Railway and Light Company. $2,000,000.

WEST CHESTER, DEL.—West Chester & Southern Street Railway Company. $42,000.

DAYTON, OHIO — Germantown Traction Company. Increase capital stock from $450,000 to $500,000.

CANASTOTA, N. Y.—Canastota & Morrisville Railway Company. $200,000. Directors: L. W. Buroughs, John Reidy, J. A. Johnson, of Morrisville; W. H. Patten, Milton Delano and John B. Weaver, of Canastota; and W. Emmett Coe, of Petersboro.

PIERRE, S. D.—Articles of incorporation of eight wireless telegraph and telephone companies, with $5,000,000 capital, have been filed by Philadelphia and Pierre citizens. The companies are intended to operate in all the new possessions of the United States, as well as in this country.

CHAMBERSBURG, PA. — Chambersburg, Greencastle & Waynesboro Passenger Railway Company. $120,000. Incorporators: T. M. Nelson, R. W. Ramsey, David Maclay, of Chambersburg; Alexander Stewart, Scotland; J. P. Rahauser, Greencastle; D. M. Good, J. J. Oller, Waynesboro, and others.

TULSA, TEX.—Red Fork & Shawnee Coal and Railway Company. F. J. Short, of Chicago, president; J. W. Hockaday, of Stroud, Okla., first vice-president; L. D. Lewis, of Tulsa, second vice-president and general manager; G. B. Robeck, of Tulsa, secretary; N. W. Bliss, of Chicago, general attorney; Edward Short, of Chicago, treasurer.

Electric Railways

The Citizens' Traction Company will build a line connecting Oil City, Pa., with Franklin, a distance of seven miles. The line will be open before summer comes.

The proposed line between Cheshire and Waterbury, Ct., for an electric railway is now being surveyed. The line will undoubtedly be built at an early day.

The electric railway between Jackson and Battle Creek, Mich., will be built this summer. A New York contracting firm is figuring upon the complete installation.

The Twin City Rapid Transit Company is planning to build an electric line to Lake Minnetonka, Minn. The road, if built, will probably only be operated in the summer time.

It is announced that Mr. A. L. Johnson has purchased another electric railway in New Jersey. This line runs from New Brunswick to Keyport, through the towns of South Amboy to Matteawan.

The Youngstown & Sharon, Pa., Electric Railway and Light Company has decided to erect a much larger power-house. A new building costing about $20,000 will be built, and new electrical machinery installed.

Construction has commenced on the Urbana, Mechanicsburg & Columbus Electric Railway, in Ohio. General H. A. Axline states that the entire line between Columbus and Urbana will be finished and in operation within a year.

The Montreal Park & Island Railway line, of Montreal, has become part of the Montreal street railway system. The deal involved $1,100,000 in cash. The newly-acquired lines are to be improved and brought up to date at once.

D. O. Fisher, of Grand Rapids, Wis., has petitioned for a franchise to build an electric railway through the main streets of that city. It is proposed to make this system a part of the electric railway from Stevens Point to Nekoosa.

A new electric road is projected by the Monroe County Electric Belt Line Company. The line is to run through the towns of Brighton, Fairport, Penfield, Pittsford and Despatch, connecting these towns with the city of Rochester, N. Y.

It is proposed to build an electric railway between the towns of Spearfish, Galena, Whitewood and other points on the line in South Dakota. N. E. Franklin, of Deadwood, and Frank R. Green, of Chicago, are interested in the enterprise.

A power plant is to be constructed in Petersburg, Va., at a cost of $1,000,000 for the Richmond & Petersburg Railway, and also to furnish power and light for the city of Richmond. The New York Trust Company is said to be financing the enterprise.

It is now proposed to run an electric road from Geneva, N. Y., to Penn Yan. The line would be from 28 to 30 miles in length, through a section of country practically without any railway facilities. The business men of Geneva are considering the proposition.

The Terre Haute, Ind., Electric Company, has filed amendments to its incorporation papers, which increases the capital stock to $1,000,000. The directors of this company are William R. McKeen, Demas Deming, J. G. McNutt, John E. Lamb and John T. Beasley.

Additions are to be made to the power-house and system of the Milford, Hollistown & Framington, Mass., Street Railway Company at a cost of about $75,000. The addition to the power-house will be about 40 feet wide and 100 feet long, of brick and stone, reinforced by steel.

Both the Ohio Central Traction Company and the Mansfield, Crestline & Galion Electric Road have franchises to operate between Galion and Crestline. There is considerable rivalry between the companies. The roads will cross a short distance north of Galion, and the first track across that section was laid by the Ohio Central Traction Company.

Something like $4,000,000 has been subscribed for a new trolley line, which will run between Chester and Wayne, Pa., to connect with the line running to Norristown. Connections will be made at Media for points east, west and south, while at the Wayne end of the line transportation will be effected into the neighboring counties of Chester and Montgomery.

The Twin City Rapid Transit Railroad reports gross earnings for May of $251,945, an increase of $27,019, as compared with the same month of last year, and net $137,605, an increase of $17,912. For the five months ending May 31, the gross earnings were $1,178,257, an increase of $91,863, as compared with the corresponding period of last year, and net $614,593, an increase of $66,160.

The Brooklyn Rapid Transit Railroad reports gross earnings for May of $1,075,576, a decrease of $11,263, as compared with the same month of last year, and net $360,415, a decrease of $68,327. For the eleven months ending May 31 the gross earnings were $10,920,179, an increase of $273,585, as compared with the corresponding period of last year, and net $3,682,280, an increase of $371,037.

Work has commenced by two Cleveland companies on electric railway lines between Norwalk and Berlin Heights. A short time ago it appeared as if the Lake Shore Company, controlled by the Everett-Moore Syndicate, and the management of the Cleveland, Berlin, Elyrian & Western Railroad would reach some agreement to obviate the construction of two parallel lines running within a few hundred feet of each other over this 10-mile strip. No agreement was reached, however, and the above companies are rushing the lines to completion.

The Columbus, Ga., Street Railway Company has sold the controlling interest to Mr. George J. Baldwin, of Savannah, Ga., and his associates, Messrs. Stone and Webster, Boston. The deal embraced about nine-tenths of the entire stock and was in round numbers about $225,000. Improvements will be made in the system at once, some $50,000 being set aside for this purpose. The Columbus Railroad owns all the street railway and electric lines of the city and also the electric light and power company. Mr. Baldwin was elected president, and Mr. John F. Flournoy was elected vice-president and general manager. Mr. W. D. Keene will remain superintendent of the railway department, and Mr. W. E. Bollieau will still have charge of the lighting and power department.

The Rapid Transit Company, of Honolulu, H. I., is reported to have exceeded its rights under the charter given it in the amount of road actually excavated by it and left incomplete, and the committee which has been appointed by the local house of representatives after having investigated the matter, states that it advocates a further investigation by the Public Works Department, and that a strict compliance with all conditions of the law be insisted upon, the Rapid Transit Company to live up to the terms of the franchise and to pay a proportionate share for all improvements, and that a certain section of the penal code regarding such matters be amended to bear directly upon such conditions. When the report was submitted to the House, a lively debate followed and adjournment was ordered, no action being taken until the matter can be given further consideration.

Personal Mention

MR. CHARLES J. GLIDDEN, of the Erie Telephone Company, sailed for Europe on Saturday last and will spend two months abroad.

MR. CHARLES F. CUTLER, president of the New York Telephone Company, sailed last week for Europe and will be absent two months.

MR. BURCHAM HARDING, of the publishing department of the Westinghouse Companies, will spend several weeks in New York in connection with the work of the department.

MR. E. O. ZWIETUSCH, a telephone manufacturer of Charlottenburg, Germany, has been visiting in New York as the guest of Mr. H. B. Thayer, manager of the Western Electric Company, New York.

MR. F. L. HUTCHINSON will soon take charge of the publishing work of the C. W. Hunt Company, New York city. Mr. Hutchinson has been for some time past connected with the Westinghouse Companies publishing department, at East Pittsburgh, Pa.

PROFESSOR WM. S. ALDRICH, for some time past in charge of the Electrical Engineering courses in the University of Illinois, and Mr. Cecil B. Smith, formerly of the engineering department of McGill University, have opened offices as consulting engineers in Toronto, Ontario.

MR. EDWARD L. LEEDS, of London, manager of the European office of the Brown Hoisting and Conveying Machine Company, visited New York and Cleveland during the past month. Mr. Leeds reports the export business of his company very large; in fact, the greatest in its history.

COLONEL JAMES L. TAYLOR, formerly third vice-president of the Consolidated Railway Electric Lighting and Equipment Company, of New York, has tendered his resignation and will hereafter engage in private business. Colonel Taylor numbers his friends by the many score in both railroad and electrical circles, and the good wishes of all will follow him.

MR. W. A. STADELMAN recently returned from a visit to San Francisco, where the interests of the Brown Hoisting and Conveying Machine Company, of which company he is eastern manager, are rapidly developing. Mr. Stadelman states that the entire Pacific coast is one immense hive of industry, and that all manufacturing companies are crowded with orders and operating companies in general are all expanding.

MR. FREDERICK P. FISH, president of the American Telephone and Telegraph Company, returned on Saturday of last week from a voyage to London after two weeks' absence, all of which, except a few hours, was spent on shipboard. On Monday of this week Mr. Fish entered the office of the American Telephone and Telegraph Company in Boston and assumed the desk and duties of president, to which he was elected the week previous.

MR. EDWARD J. HALL, general manager of the American Telephone and Telegraph Company, and Mr. William Dunlap Sargent, vice-president and general manager of the New York & New Jersey Telephone Company, returned last week from a European trip of a month. It seems the proper thing for hard-worked electrical men to take their rest on shipboard and these gentlemen spent nearly three weeks of one month's absence in this way.

Industrial Items

SIPE & SIGLER, Cleveland, Ohio, have been awarded the contract for a battery of 64 cells of 800-ampere-hour capacity, which is to be installed at the Skuylkill Arsenal, Philadelphia, Pa.

MR. JAMES W. JACKSON, formerly in charge of the engineering and lighting of the famous Park Row Building, New York city, is now the proprietor of the Nixon safety stay bolt sleeve, 10 Barclay street, New York.

MR. THOMAS A. EDISON'S new company, organized to manufacture storage batteries under his patents, has completed its factory arrangements, and will manufacture at Glen Ridge, N. J., where a building is available.

THE PACIFIC ELECTRIC COMPANY, La Crosse, Wis., reports that its new fan lamp recently illustrated in the ELECTRICAL REVIEW is meeting with a great sale. It is certainly a very convenient article for one's desk these hot days and nights.

THE ELECTRIC APPLIANCE COMPANY, Chicago, has issued a complete catalogue of telephone and annunciator systems, in addition to the regular telephone catalogue. Contractors and telephone men who have been missed in the distribution, will be supplied upon application.

THE GOULD STORAGE BATTERY COMPANY, New York city, is making marked headway with its high output electric vehicle batteries. The new Gould "mobile" battery, while designed to accomplish long runs without damaging the plates, is remarkable for the weight efficiency obtained.

"A COOL BREEZE APPARATUS" is the title of a very beautiful catalogue recently sent out by the Boston Electric Heating and Power Company, Boston, manufacturer of electric fans and heating apparatus. At this season of the year interest in the heating apparatus is not so strong as is that displayed in the fans, etc., made by this company, several types of which have been illustrated in recent numbers of the ELECTRICAL REVIEW. These fans possess many novel features, among them noiseless running and wide distribution of air, instead of the customary searchlight blast.

THE AMERICAN ELECTRIC TELEPHONE COMPANY, of Chicago, among many contracts for telephone plants recently closed, reports the following: Mansfield, Ohio, common battery, 1,200 installed, with provision for 3,000; Reading, Pa., central energy, 1,500 lines, with 5,000 ultimate capacity; Zanesville, Ohio, common battery, 1,200 connected, with 3,000 ultimately; Huntington, Ind., 800 at present, to increase to 1,500; Austin, Tex., with 1,200 for immediate connection, 3,000 ultimately; Temple, Tex., and Tyler, Tex., 600 ready to connect, will provide for increase to 1,500; Xenia, Ohio, 600 in operation, provision for 2,000, and Oklahoma City, Ind. Ter., 750 subscribers on 1,200-line switchboard.

"AMERICA'S GREAT RESORTS"—The new issue of "Four-Track Series" No. 3, an illustrated and descriptive folder, 48 pages, entitled "America's Great Resorts," has just been issued by the passenger department of the New York Central. This folder gives a description of a large number of the great health and pleasure resorts reached by the New York Central, and shows the time and rates of fare to the different points, not only from New York, but from all the principal cities along the line. It also contains a large map in colors, which is a marvel of accuracy. A copy of this folder will be sent free, post-paid, to any address, upon receipt of a postage stamp, by George H. Daniels, general passenger agent, Grand Central Station, New York.

RUBEROID, the insulating roofing material manufactured by the Standard Paint Company, New York and Chicago, is about to take a trip to the North Pole. The Baldwin-Ziegler Polar Expedition, which will proceed to the Arctic this summer, is carrying along a large amount of galvanized wire netting and of ruberoid. This will be used to build housings and enclosures and to house over the ship when it becomes locked in the ice of next winter. Of it will be made huts and shelters for 40 men and hundreds of dogs and other animals and their supplies. It was found that this material, which is light in weight, entirely impervious and an excellent insulator against cold, is much lighter and less bulky than the usual boards and timbers that have been carried by former Arctic expeditions.

THE MONTAUK FIRE DETECTING WIRE COMPANY—The following announcement has been received: The corporation known as the Montauk Multiphase Cable Company will hereafter be known as the Montauk Fire Detecting Wire Company. This change of name is not on account of reorganization of the company, but has been made for the purpose of more fully conveying to the public the nature of our business. We have received so many communications which indicate that wrong conclusions have been drawn as to the product we manufacture that it was deemed advisable by the stockholders at their annual meeting, May 1, 1901, to adopt the following corporate name: Montauk Fire Detecting Wire Company, John D. Gould, president.

THE NATIONAL INDIA RUBBER COMPANY has removed to No. 253 Broadway (Postal Telegraph Building), and each department is now represented from that office: the rubber insulated wire and cables department by Mr. Henry D. Stanley; hose, belting and packing by Mr. A. B. Pratt; rubber clothing and mackintoshes by Mr. Geo. H. Payne. The officers of the company are: Colonel S. B. Colt, president; H. H. Shepard, general manager; Wm. Hodgkinson, assistant general manager; W. DeF. Brown, secretary. The National India Rubber Company is sending out a very complete list, No. 8-W, of wires and cables to new code specifications, and will send a copy to any one desirous of possessing a very complete list, indeed. A request addressed to Mr. Henry D. Stanley will have prompt attention.

MR. F. EULER, of 35 Broadway, New York, importer and exporter of general electrical supplies, has a number of novelties in reflectors and reflector shades for incandescent electric lamps. Among these is the "Helios," which has a concave silver glass reflector connected with a movable diffusible globe made of prismatic glass, tending to deliver the reflected light in useful directions. Its efficiency is very high and its handsome finish and appearance make it a very attractive fixture. The reflector base can be inserted in any socket. The "Miro" reflector shades have a reflector surface of hollowed glass backed with silvering. These are made in various shapes and sizes and will not tarnish or turn dull. The "Elektra" reflector shades are made of patent hard porcelain combined with a silvering applied to the reflecting surface. The shade is very durable and highly efficient.

MR. JAMES G. BIDDLE, Stephen Girard Building, Philadelphia, has just taken a very important order covering the instrument equipment of a new laboratory about being established in New York city by the Lamp Testing Bureau, which operates under the auspices of the Association of Edison Illuminating Companies. Before placing the business the experts of the Lamp Testing Bureau, as well as its president, Mr. John W. Lieb, Jr., gave the subject most careful attention with a view of securing apparatus of the highest quality, whether manufactured in America or Europe. Price was a secondary consideration, and Mr. Biddle's bid was not the lowest one received by any means. The order comprises a large amount of apparatus manufactured by Morris E. Leeds & Company, Philadelphia. Among the more important items being an Anthony type resistance box and Wheatstone bridge, Leeds standard laboratory potentiometer with volt box and low-resistance standards, Reichsanstalt type photometer, special portable potentiometer, special resistance box of about 100,000 ohms, Leeds portable testing set, Rowland electrodynamometer with shunt box, D'Arsonval galvanometers, etc. In addition the order comprises some Weston semi-portable laboratory standard instruments, Weston standard cells and a few foreign instruments, such as Weber portable photometer, Heffner lamp with Reichsanstalt certificate, special Lummer-Brodhun photometer screen, etc.

Automobile Notes

The first electric cabs have been put in service at Vienna, Austria. The undertaking has received a concession for the establishment of 16 charging stations and it is intended rapidly to enlarge and increase the service.

An English physician, writing in the *Lancet*, has compared his expenses in making his round of visits in the country when he used a horse and now that he is using an automobile. His results show the annual cost to be £25 10s. 6d. with the automobile, and £50 7s. for a horse and buggy.

The application of Benjamin Meyer as a stockholder for an order restraining the New York Electric Vehicle Transportation Company from collecting a second installment of 10 per cent on its stock was denied on Monday of this week by Vice-Chancellor Pitney, at Jersey City. The Vice-Chancellor said that from all he could see the company was entering into timely and profitable enterprises which were entirely within the range of its charter, and he denied the motion.

Obituary Notice

MR. SAMUEL SIAS, treasurer of the Boston Electric Light Company since its incorporation some 15 years ago, died at his home in Cambridge, Mass., Wednesday night of last week, aged fifty-eight. Mr. Sias was also a director of the American Pneumatic Service Company and was a member of the Exchange and Algonquin Clubs, of Boston. He was well known in electrical circles of Massachusetts and was an intimate associate of the late president of the Electric company, Mr. Frederick A. Gilbert, who, it will be remembered, died suddenly in New York city a few months ago.

Current Literature

THE *DELINEATOR*, of New York, in its issue of July, 1901, publishes a very interesting article descriptive of the Pan-American Exposition. It presents in colors taken from the original sketches by Mr. C. Y. Turner, director of colors to the exposition, a number of illustrations. Included in these color pictures, which are very attractive, are the tower entrance to the Electricity Building, and the general scheme of the Electricity Building.

List of Electrical Patents Issued Last Week

[Specially reported for this journal by E. S. Duvall. solicitor of patents, Loan and Trust Building, Washington, D. C. Copies of any patent may be secured for 10 cents each.]

ISSUED JUNE 25, 1901.

676,881 Self-locking insulator and pin; H. Etheridge, McKeesport, Pa.

676,888 Electric railway system; E. Frsichmith, Berlin, Germany.

676,949 Electric heater; G. C. Hawkins, Boston, Mass.—A fan composed of cones with blades between said cones and secured thereto, a motor for operating said fan, an electric heater consisting of one or more heat-developing electric conductors or resistances located in and passing through said blades between said cones, and insulating means in the blades for the electric conductors.

676,952 Electric lamp; C. A. Hussey, New York, N. Y.

676,955 Telephone system; F. A. Lundquist, Chicago, Ill.—A central telephone station, a series of telephones, and connections from the central station to the telephones, a spring-jack, a lever movable to two extreme positions, one of which covers the opening to said spring-jack and a spring arranged to hold said lever at either extreme position.

676,956 Calling device for telephone exchanges; F. A. Lundquist, Chicago, Ill.

676,965 Means for recharging storage batteries of electric vehicles; J. Sachs, Hartford, Conn.—A storage battery, a motor electrically actuated thereby, and devices for increasing the field strength of the motor when the motor is driven as a dynamo by the free running of the vehicle.

676,985 Electric smelting furnace; Hugo Koller, Nuremberg, Germany.

677,005 Feeding and regulating mechanism for arc lamps; W. E. Waldron, Colorado Springs, Colo.

677,019 Electric arc lamp; F. M. Conway, New York, N. Y.—Consists of an annular resistance coil, a central hanger, armed supporting bracket, a centering cap, a clamp nut and suitable packing.

677,026 Electric brake; F. W. Garrett, Johnstown, Pa.—Consists of a rotary brake member, a bar of magnetic material capable of a movement toward and away from the periphery of said brake member, and having pole-pieces which form shoes for contact with said surface, coils on one of the said pole-pieces, means for energizing said coils, means for sending a reverse current around the other of said pole-pieces, and a spring tending to hold said bar away from said brake member.

(Continued on page 32.)

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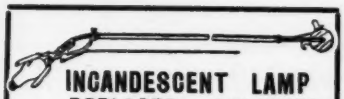

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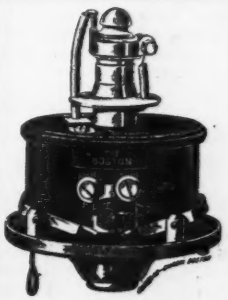

"BOSTON" MECHANISM

PATENTS.

(Continued from page 31.)

677,027 Operating means for electric controllers; F. W. Garrett, Johnstown, Pa.—Consists of a regulating-switch, a reverse-switch, a handle for the reverse-switch, a guard plate underneath the said handle, and means for moving said plate toward and away from the said handle.

677,038 Control of electric motors; F. A. Merrick, Johnstown, Pa.—The method of controlling a pair of electric motors, which consists in starting them from a position of rest connected in series with each other, then connecting their field coils in parallel and in series with the series-connected armatures, then shunting one motor with the field of the other motor, then shunting one of the motors with the armature of the other motor, and finally connecting both motors in parallel.

677,049 Electric lamp cluster-fixture; N. Weeks, New York, N. Y.

677,070 Electrical heating-furnace; A. H. Eddy, Windsor, Conn.

677,071 Collector for electric generators and motors; A. H. Eddy, Windsor, Conn.—A collector for electric generators and motors, consisting of a cemented mixture of particles of oxide of metal and particles of pure metal.

677,145 Combined brake and power controller; E. W. Stull, Johnstown, Pa.

677,156 System of charging storage batteries; G. H. Condict, New York, N. Y.

677,169 Alarm apparatus for engine-room telegraphs or the like; Thos. Bell, Liverpool, England.

677,191 Electric controller; A. C. Eastwood, Cleveland, Ohio—A frame, contact-plates supported thereby, an operating-lever pivoted to said frame, a guide-bar supported on the frame, a brush-holder arm sliding on said bar and having ends constructed to enter slots in the operating-lever, and brushes on the said arm, constructed to form electrical contact with the contact-pieces.

677,226 Method of producing electrical energy from carbonaceous materials; H. Jones, Chicago, Ill.

677,238 Incandescent lamp; I. Kitseek, Philadelphia, Pa.—The method of lowering the resistance of an incandescent lamp, consisting of a material non-conducting at low, but conducting at high temperature, which consists in moistening the material designed to become incandescent with a liquid conductor of electricity.

677,244 Secondary battery; A. F. Madden, Newark, N. J.—A storage battery electrode, including a conductor or grid, having openings within surrounding walls and projections or fingers extending from said walls into the openings, and active material closing the openings and entirely surrounding said projections or fingers.

677,245 Apparatus for making secondary battery plates; A. F. Madden, Newark, N. J.

677,247 Electrically-operated plow; C. Meissner, Friedrichsberg, Germany.

677,269 Reversible switch; G. H. Proctor, Somerville, Mass.

677,296 Circuit testing and recording apparatus; G. A. Wall, Providence, R. I.

677,308 Alternating-current motor; Carl Eickemeyer, Yonkers, N. Y.

REISSUES.

11,916 Electric arc lamp; E. W. Rice, Jr., Schenectady, N. Y.—An arc lamp provided with a plurality of stationary electrodes adapted for connection with currents differing in phase, a single movable electrode in circuit and a regulator controlling said electrode to adjust and maintain the arc.

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